Agriculture Dept.
Punjab
Report on operations
1918-19 to 1920-21
(Annual Experimental Record)

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for 1918-19.

ANNUAL EXPERIMENT RECORD.

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REPORT

ON THE OPERATIONS OF THE

DEPARTMENT OF AGRICULTURE, PUNJAB,

FOR THE YEAR ENDING 30TH JUNE 1919.

PART II.

134233

Annual Experiment Record.

Lahore :

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRINTING, PUNJAB.

1920.

PART II.

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Experiments at the Lyallpur Agricultural Station by Mr. W. Roberts, Professor of Agriculture, Punjab, Lyallpur, during the year 1918-19.

1. *Introductory.*—I held charge of the Agricultural Station except from January 8th to April 8th when I was on leave and the work was carried on by Mr. Faulkner.

2. The rainfall of the season totalled 8·14 inches as compared with 23·93 inches for previous season and an average of 13·11 inches for five years and 14·045 inches for ten years previously. (See statement 1). The prevalence of influenza in October and November affected Rabi sowing and cultivation unfavourably, as did likewise the shortness of rainfall in September and October. Apart from this the Rabi season was very favourable for wheat and the timely rains from December were beneficial. Gram suffered rather severely from wilt. The Kharif season was favourable for irrigated tracts but more rain in September would have been much appreciated. The season was very favourable for maize and sugarcane.

3. *Experiments on the Farm: all on irrigated land.*

(Note.—Average yields are calculated per acre.)

Cultural and other experiments in area C, square 27, with *sugarcane, wheat and maize.*

The rotation is maize, senji (as a catch crop) sugarcane, wheat. The maize is manured.

Sugarcane.—Testing different systems of hoeing. The usual practice with cane is to do "Ani-godi" or blind hoeing by "baguri" and this takes 6 men to do an acre and costs therefore Rs. 5. Labour costs at least 14 annas a day at that time. Very often the labour is not available in quantity and much of the land gets hard before hoeing is completed. Bar-harrowing costs Re. 0-12-0 for doing twice over—this is assuming Re. 1-8-0 as cost for one day.

The averages are—

	Mds.	*Srs.*
1st Plot.		
Blind hoeing	41	22
Bar harrow	42	21
Blind hoeing	54	19
2nd Plot.		
Spring Tine Harrow	52	24
Blind hoeing	45	28
Horse hoeing	39	13

The yields are exceptionally high but no conclusive results can be drawn. Future trials will be confined to Bar Harrow and Blind Hoeing (See statement No. 2.)

4. *Harrowing versus no-harrowing with wheat —*

	Mds.	*Srs.*
Harrowing produced positive results in all four plots. Average yield of harrowed plots	28	30
Non-harrowed plots	24	20

(See statement No. 3.)

5. *Sowing maize by "Kera" and khurpa hoeing (by hand)* versus *Drills 2 feet apart and bullock hoeing.*—The cost of hand hoeing is Rs 4 per acre and of bullock hoeing 0-8-0 : hence 4 bullock hoeings cost only Rs. 2. Plots were damaged by crows especially in 1 and 4. The line plots yielded more by 22 seers which is too little to be regarded as more than an indication.

(See statement No. 4.)

6. *Sowing maize "Kera" and lines with tenants.*

(Statement No. 5). Results very uneven and very little interculture done. Average over one maund in favour of "Kera."

7. *Senji in square 27 after maize*—Statement No. 6. No experimen t.

8. *Experiments in area D square 27—Deep Ploughing.*—Up to last year a series of complicated manurial experiments were carried out here but these have now been modified and simplified and new plots laid out. In area D/K where rotation was sugarcane, cotton, maize, the present rotation is wheat followed by American cotton then wheat again after 9 months' fallow, *i.e*, a 2 years' rotation of wheat and American cotton. The plots receive different cultural treatment, *viz.*, 6 inches ploughing plus subsoiling versus 6 inches ploughing and 9 inches ploughing versus 6 inches ploughing. In each case iron ploughs are used once as long as possible before sowing to allow time for weathering (See statement No. 7 for results). Results as shown in statement indicate beneficial effect of deep-ploughing for wheat. Plots are however somewhat uneven as yet. See statement No. 7*a*, showing results of maize, chari, mixture before wheat indicating unevenness of plots.

Cotton will be dealt with in next year's report.

9. *Area D/R now F1 and F2 (manurial experiments).*—The rotation here used to be "wheat, toria, gram"—it is now in F1, maize, wheat, American cotton—manures applied to maize and cotton only. There are three principal crops in two years.

In F 2 the rotation is maize (senji), American cotton, *i.e.*, two principal and one catch crop in 2 years. Manure is applied to maize and cotton only. Farmyard manure is given at rate of 5 tons per acre and other artificials in quantities giving same amount of N, P or K as in Farmyard manure, both in F1 and F2 the plots are arranged as follows :—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Farmyard manure.	$Na\ No_3$.	Control.	Bone meal.	$K_2\ So_4$.	Control.	Bone meal $Na\ No_3$. $K_2\ So_4$.	Control.	Farmyard manure.	as in plots 1 to 8.						

10. *Maize in F1 Square 27.*—See statement No. 8. Results appear to show *large effect of Nitrates.* Barley was sown after maize this year—residual effect of Nitrate apparent in this also especially when assisted with other manures. See statement No. 9.

11. *Manurial Experiments.*—F2 square 27.

Maize, same as above. Senji, see statement No. 16.

See statements Nos. 10 and 11.

12. *Cultural experiments with American cotton (square 26-A-2).*—The yields were very poor throughout but ridging gave a higher yield by nearly one maund (actual 33 seers) than plots sown and cultivated on flat. In each case less water was used, also in ridged plots.

13. *American cotton sown broadcast and in lines in square 32, area C.*

Land is uneven in New Area but results show average—

of lines	...	= 8 maunds	33 seers.
of broadcast	...	= 7 maunds	15 seers.

As regards number of waterings results are inconclusive. (See statement No. 13).

14. *Sowing cotton in lines* versus *broadcast with tenants* —See statement 14.

Line plots received one watering less than broadcast. Latter were ploughed as usual once on 31st August. The broadcast plots were much weedier than line plots. Results show very heavy increases in favour of line sowing and inter-culturing. In case of 4-F increase is 6 maunds 4 seers and in case of Roseum 6 maunds 8 seers.

15. *Drilling and Ridging* versus *no Ridging for Maize.*—Tenants area squares 6 and 17.

Results show slight increase in favour of ridging as in case of cotton.

16. *Hydraulic experiments in square* 10.—Plot 10 C/a1 and 10C/a2, statement No. 7.

Sanguineum (Deshi) cotton—Treatment as per statement. Results show that with this cotton even with a dry year *no watering* up to July gave best results.

16-*a*. See statement No. 16 also for results of line *versus* broadcast sowing for cotton. Results strongly in favour of line sowing.

17. *Wheat.*—(Early sown).—See statement No. 18. It will be seen that in heavy land a very good crop can be obtained on 10 or 11 inches water. Averages work out slightly in favour of plots which received three waterings instead of two after sowing.

18. *Wheat.*—(Late sown).—See statement No. 19. Yields lower generally, as plots not so rich. Average works out in favour of three waterings in spite of the fact that one of the plots with two waterings having excellent soil gave a very high yield.

19. *Toria.*—(Early sown). Plots receiving only one irrigation after sowing suffered more from Tela in some cases. The average yield however as will be seen is slightly in favour of one watering.

20. *Toria.*—(Late sown). Here again one watering after sowing gives a better yield than two waterings.

21. *Hot weather* versus *rain ploughing for wheat.* (Tenants area.) See statement 22.

Yield of hot weather ploughing plots is higher by 38 seers on the average thus confirming the previous results except last years. Plots were reversed this year, *i.e.*, rain ploughing was done in hot weather plots of previous years.

22. *Different methods of sowing toria.*—(Tenants area). See statement 23.

Results are uneven and to the eye the only apparent effect was better germination with harrowing.

23. *Harrowing* versus *no-harrowing after sowing Toria in square* 26.—See statement No. 24. Visual effect of harrowing in causing thick germination very apparent. Yields however show slight advantage, *viz.*, 10 seers per acre in favour of no-harrowing which is contrary to last year's results. The harrowed plots should receive less seed rate in future.

24. *Harrowing* versus *no-harrowing after sowing Toria in square* 32, *Block D. New Area.*—Same remarks apply—harrowing in this case better by 8 seers per acre.

MANURIAL EXPERIMENTS.

25. *Green manuring of wheat in square* 2 *and residual effects in two succeeding years.*—See statements Nos. 25, 26 and 27. The land is very poor and uneven.

26. *Green manuring with Guara* versus *Fallow.*—See statement No. 28. Increased yield of one maund 20 seers only as result of green manuring indicates that in land of this kind some years must elapse before a good crop can be obtained. See also statement No. 30.

27. *Green manuring in Tenants' Area.*—See statement No. 29. Sann gave better results than Guara which is contrary to experience of recent years.

28. *Sodium Nitrate on wheat.*—Square 7.—Results confirm previous year's in that Nitrate alone given annually does not pay. This experiment has been in progress for several years and is being continued for experimental reasons only. Statement No. 31.

29. *Manurial experiments with sugarcane.*—(Tenants area.) Toria Cake *versus* no manure and Toria Cake *versus* Farmyard Manure. See statement No. 32. No definite result as plots uneven.

VARIETAL EXPERIMENTS.

30. *Wheats.*—Punjab 11 and Pusa 12. New Area. In this test 12 plots received two waterings after sowing and 12 received three. Averages show three waterings gave better yield by 2 maunds per acre in Punjab 11 and by 30 seers in Pusa 12. As against one another Punjab 11 gave a better yield by 1 maund 6 seers in two waterings and by 2 maunds 16 seers in three waterings. Further tests of Pusa 12 will be discontinued. Statement No. 33.

31. Very extended trials of No. 8-A wheat were conducted this year as statements Nos. 34*a*, 34*b*, 35, 36, 37, 38 and 39 indicate. These will be discussed separately.

32. *No. 8A, 8B and No. 11 in square* 26.—In 34*a* crop follows wheat—in 34*b* cotton. After wheat No. 11 yields slightly better than 8-A, *viz.*, 15 seers per acre, whereas after cotton 8-A is superior by 2 maunds 4 seers. As in previous years 8-B stands well below both.

33. *No. 8A, 8B and No. 11 in New area.*—A series of strips of these wheats were grown in this area giving 18 plots of each. This test may be regarded as very reliable owing to the very large number of plots. The average yields are :—

	Mds.	*Seers.*
8A	24	14
Punjab 11	25	37
8B	20	18

or a greater yield by 1 maund 23 seers in case of No. 11. No. 11 gave a better yield in 13 plots out of 18 and an equal yield in one plot. See statement No. 35.

34. *No. 11 and 8-A with Tenants.*—There were again 18 plots of each variety, two in each killa—Punjab 11 is superior in 12 plots and on the average yielded 1 maund 3 seers more per acre. Statement No. 36. In the year under report therefore No. 11 has come again to the front and undoubtedly did better. This is contrary to last year's results. The very dry and warm weather in latter part of March and in April rendered this season a short one and therefore more favourable for earlier wheats. See last year's remarks.

35. Some observations were made this year on the average tillering power of 8-A, 8-B and No. 11. The figures are :—

No. 11	2·7	per plant.
No. 8-A	3	do.
No. 8-B	2·4	do

In practice No. 8-B is given 4 seers extra seed rate.

36. *No. 11 and 8-B.*—See statement No. 37. No. 11 yields better by 2 maunds 14 seers. No. 8-B will be discontinued in future.

37. *Nos.* 8-*A and* 8-*B.*—See statement No. 38. As expected 8-A yields better by 1 maund 37 seers per acre.

38. *Punjab* 17 *and No* 8 *B.*—See statement No. 39. Only 4 plots in this case average in favour of Punjab 17.

39. *Barleys.*—Nos. 1, 2, 5 *versus* local variety.

Three varieties handed over by Economic Botanist could only be tried in one plot each. These barleys will receive more extended trials next year. They ought to be in more typical barley tracts, *e g.,* Ferozepore, Gurgaon or possibly Hansi. See statement No. 40.

40. *Grams.*—Four grams Nos. 17, 20, 7, 15 were tried against local in one test each. Nos. 7 and 17 seem promising but further trials are necessary. Statement No. 41.

41. *Cottons.*—The following American cotton varieties were under trial during the year, *viz.*, No. 280-F., 285-F., and 276-F., and Risala cotton.

42. *Trial of Nos. 280 and 4-F.*—Tested in 18 plots each with tenants. Average works out as follows :—

	Maunds.	*Seers.*
4-F	11	8
280-F	9	35

or a greater average yield of 1 maund 13 seers in favour of 4-F. In 13 out of 18 tests No. 4-F. leads. As the extra value which could be obtained for 280-F. would not amount to more than Re. 1-8-0 a maund at most, it is obvious that 4-F. is the more profitable cotton. The ginning percentage of 280-F. is nearly 1 seer less per maund than 4-F. Statement No. 42.

43. *4-F. and 276-F.*—No. 276-F. is similar in quality to 4-F. Yields are very similar—4-F. leading by 5 seers per acre on the average. See statement No. 43.

44. *4-F. and Risala (American cotton).*—Risala cotton is in quality similar to 4-F. and is now fairly uniform. Yields similar; 4-F. being beaten by 12 seers per acre. See statement No. 44.

45. 4-*F. and* 285-*F.*—285 F. is the finest American cotton on the Farm and has been well reported on in commercial centres and by the Indian Cotton Committee. In habit it is more upright than 4-F. and taller, it is also less rough-leafed. The stand of 285-F. was somewhat thinner than 4-F. though the same seed rate was used, but as seed of 285-F. is very large, actual number of seeds would be less per acre. A higher seed rate for 285-F. is being used this year. In spite of this however it is pretty certain 285-F. will be a poorer yielder than 4-F. This year's results show 2 maunds 5 seer in favour of 4-F. See statement No. 45.

DESHI COTTONS.

46. *Roseum and Neglectum.*—As in previous years Roseum yielded much better. Average increased yield = 3 maunds 25 seers in the year under report. See statement No. 46.

47. *Roseum and Mollisoni.*—Both these cottons are white flowered, the latter being an 'Indicum.' They were tested in 12 plots each results practically equal *viz.*, 3 seers in favour of Mollisoni. In the past Mollisoni has generally done slightly better. Its ginning percentage is nearly 16 as compared to 15 seers for Roseum. See statement No. 47.

48. *Roseum and Sanguineum.*—Sanguineum or Multan cotton is draught resisting like Roseum. Yields 1 maund 17 seers in favour of Roseum. (See statement No. 48).

49. Tests in Tenants' area of 4-F., 280, 285, 276 and Risala—see statement No. 49,—confirm above. This applies also to Deshi cottons.

W. ROBERTS,

Professor of Agriculture, Punjab,

Lyallpur.

Statement No. 1.

SHOWING RAINFALL AT THE LYALLPUR AGRICULTURAL STATION DURING THE YEARS 1917-18 AND 1918-19.

1	2	3	4
Name of month.	Rainfall during 1918-19.	Rainfall during 1917-18.	Remarks.
June	·09	2·51	
July	·82	2·79	
August	3·29	6·97	
September	·57	10·43	
October	·16	...	
November	...	...	
December	·43	...	
January	1·27	·01	
February	·27	·03	
March	·26	·72	
April	·26	·47	
May	·72	...	
Total ...	8·14	23·93	

Average rainfall for the last 5 years ... ... 13·110

Average rainfall for the last 10 years ... ... 14·045

Statement No. 2.

OUTTURN OF KATHA SUGARCANE GROWN IN ROTATION SERIES, AREA C, SQUARE 27, KHARIF 1918.

No. of plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Weight of green tops. Maunds.	Weight of green tops. Seers.	Weight of green tops. Chataks.	Weight of cane. Maunds.	Weight of cane. Seers.	Weight of cane. Chataks.	Weight of juice. Maunds.	Weight of juice. Seers.	Weight of juice. Chataks.	Weight of gur. Maunds.	Weight of gur. Seers.	Weight of gur. Chataks.	Yield of gur per acre. Maunds.	Yield of gur per acre. Seers.	Yield of gur per acre. Chataks.	Percentage of green tops to cane.	Percentage of juice to cane.	Percentage of gur to juice.	Percentage of gur to cane.	Dates of waterings.	Remarks.
C-3	1	Blind hoeing with Baguri	...	17 7/9	26	9	0	42	28	0	22	16	0	4	6	0	37	14	0	61·4	52·4	18·5	9·7	8th May 1918.	Ploughings 7
	2		...	17 7/9	24	2	0	49	27	0	27	8	0	5	8	0	46	32	0	48·4	54·7	19·1	10·4	22nd May 1918.	Harrowings 3
	3		...	17 7/9	23	21	0	47	26	0	25	4	0	4	20	0	40	20	0	49·3	52·6	17·9	9·4		Sohagaings 4
	4	Bar harrowing ...	...	17 7/9	24	39	0	45	21	0	24	21	0	4	27	0	42	3	0	54·8	53·8	19·06	10·2	3rd June 1918.	Hoeings and harrowings 9
	5		...	17 7/9	25	20	0	41	25	0	24	21	0	4	20	0	40	20	0	61·2	58·9	18·3	10·8	22nd June 1918.	Waterings 14
	6		...	17 7/9	23	33	0	47	37	0	25	13	0	5	0	0	45	0	0	49·7	52·8	19·7	10·4		Date of sowing—4-5th April 1918.
	7	Blind hoeing with Baguri ...	...	16 8/9	27	1	0	52	16	0	30	16	0	5	33	0	55	7	0	51·5	57·5	19·3	11·1	2nd July 1918.	
	8		...	14 25/25	21	9	0	47	1	0	27	8	0	5	0	0	56	17	0	45·1	57·8	18·3	10·6	16th July 1918.	Crushing began on 11th January and finished on 12th February 1919.
	9		...	16 5/18	24	34	0	50	25	0	27	8	0	5	12	0	52	3	0	49·08	53·7	19·4	10·4		
	10	S. T. harrow ...	...	17 7/9	26	14	0	58	20	0	32	22	0	6	6	8	55	18	8	45·04	55·6	18·9	10·5	29th July 1918.	
	11		...	15 8/9	23	24	0	51	27	0	27	8	0	5	11	0	53	4	12	45·6	52·6	19·3	10·2	11th August 1918.	
	12		...	17 7/9	26	2	0	52	12	0	30	5	0	5	19	0	49	11	0	49·8	57·6	18·1	10·4		
	13	Blind hoeing with Baguri ...	...	17 7/9	26	16	0	56	23	0	28	22	0	5	25	0	50	25	0	46·6	50·4	19·7	9·9	9th September 1918.	
	14		...	17 7/9	26	13	0	47	12	0	25	24	0	4	29	0	42	21	0	55·6	54·1	18·4	9·9	22nd September 1918.	
	15		...	17 7/9	29	36	0	50	35	0	26	6	0	4	35	8	43	39	8	58·7	51·4	18·6	9·6	18th October 1918.	
	16	Horse hoeing ...	...	17 7/9	25	14	0	41	19	0	24	0	0	4	20	0	40	20	0	61·1	57·8	18·7	10·8		
	17		...	17 7/9	25	27	0	43	39	0	22	16	0	4	9	8	38	5	8	58·3	50·9	18·9	9·6	3rd November 1918. 5th December 1918. 31st December 1918.	

	Mds.	Srs.	Chks.
Average yield of 17 plots	46	16	7½

Average outturn of gur per acre of each set separately—

	Mds.	Srs.
Blind hoeing with "Baguri"	41	22
Bar harrow	42	21
Blind hoeing	54	19
S. T. Harrow	52	24
Blind hoeing	45	28
Horse hoeing	39	13

	Mds.	Srs.
Average yield per acre of 2 plots receiving blind hoeings ...	47	25

Statement No. 3.

RESULTS OF HARROWING *VERSUS* NO HARROWING ON WHEAT GROWN IN ROTATION SERIES, AREA C, 5 SQUARE 27, RABI 1918-19.

No. of plot.	No. of sub-plot.	Variety.	Treatment.	Area in acres. Kanals.	Area in acres. Marlas.	Actual outturn. Grain. Mds.	Grain. Seers.	Grain. Chataks.	Bhusa. Mds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Mds.	Grain. Seers.	Grain. Chataks.	Bhusa. Mds.	Bhusa. Seers.	Bhusa. Chataks.	Dates of waterings.	Remarks.
C-1	1	Punjab type 11.	No harrowing ...	2	0	5	10	0	9	12	0	21	0	0	37	8	0	12th February 1919. 26th March 1919.	Ploughings 7
	2		Harrowing ...	2	0	6	30	0	13	38	0	27	0	0	55	32	0		Harrowings 3
	3		No harrowing ...	2	0	5	36	0	9	32	0	23	24	0	39	8	0		Sohagaings 7
	4		Harrowing ...	2	0	7	2	0	13	0	0	28	8	0	52	0	0		Surface Harrowing to plots Nos. 2, 4 6 and 8.
	5		No harrowing ...	2	0	6	33	8	12	6	8	27	14	0	48	26	0		Date of sowing—9th December 1918.
	6		Harrowing ...	2	0	7	23	8	11	2	8	30	14	0	44	10	0		Date of harvesting—1st to 3rd May 1919.
	7		No harrowing ...	2	0	6	20	12	11	38	0	26	3	0	47	32	0		
	8		Harrowing ...	2	0	7	14	8	10	29	8	29	18	0	42	38	0		

	Average yield per acre. Mds.	Srs.
Harrowed	28	30
Not harrowed	24	20¼

Statement No. 4.

RESULTS OF DIFFERENT METHODS OF SOWING MAIZE IN ROTATION SERIES AT THE LYALLPUR AGRICULTURAL STATION, KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Name of variety.	Treatment	Area in acre.	Weight of dry stalks. Maunds.	Weight of dry stalks. Seers.	Weight of dry stalks. Chataks.	Weight of fresh cobs. Maunds.	Weight of fresh cobs. Seers.	Weight of fresh cobs. Chataks.	Weight of dry cobs. Maunds.	Weight of dry cobs. Seers.	Weight of dry cobs. Chataks.	Weight of grain. Maunds.	Weight of grain. Seers.	Weight of grain. Chataks.	Yield per acre. Maunds.	Yield per acre. Seers.	Yield per acre. Chataks.	Dates of waterings.	Remarks.
27 C-2	1	Red local maize.	"Kera" sown by hand behind the country plough.	½	20	6	0	26	6	0	17	29	0	13	25	0	27	16	0	13th September 1918. 22nd September 1918.	
	2		Lines two feet apart	½	21	27	0	26	31	0	17	33	0	13	29	0	27	38	0	3rd October 1918	
	3		"Kera" sown by hand behind the country plough.	½	29	23	0	25	30	0	15	31	0	12	26	0	25	12	0	18th October 1918 3rd November 1918.	
	4		Lines two feet apart	½	22	20	0	25	37	0	16	10	0	12	34	0	25	28	0	5th December 1918.	

Ploughings 4

Harrowings ... ...

Sohagaings 3

Bullock hoeings in plots No. 2 and 4 4

Plots No. 1 and 3 received one khurpa hoeing.

Date of sowing—16th August 1918.

Date of harvesting—10th December 1918.

N.B.—Crows did some damage as the crop was late. There was more damage in plots Nos. 1 and 4 than 2 and 3.

Average yield.

Treatment.	Total area.	Total yield. Mds.	Srs.	Chs	Yield per acre. Mds.	Srs.	Chs.
"Kera" sown by hand behind the country plough.	One acre ...	23	11	0	26	11	0
Lines two feet apart	One acre ...	26	33	0	26	33	0

Statement No. 5.

DIFFERENT METHODS OF SOWING MAIZE IN TENANTS AREA, KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Variety.	Treatment.	Area. Kanals.	Area. Marlas.	Weight of fresh cobs. Maunds.	Weight of fresh cobs. Seers.	Weight of dry cobs. Maunds.	Weight of dry cobs. Seers.	Weight of grain. Maunds.	Weight of grain. Seers.	Yield of grain per acre. Maunds.	Yield of grain per acre. Seers.	Remarks.
3														
24	1	Red local maize.	Kera behind the country plough	1	19	16	3	13	5	10	15	42	$22\frac{9}{16}$	No hoeing.
	2		Lines 2′ apart	1	19	15	35	12	12	9	26	39	$23\frac{9}{16}$	One hand hoeing and one bullock hoeing.
	3		Kera behind the country plough	1	19	18	9	14	2	11	9	46	$2\frac{1}{16}$	No hoeing.
	4		Lines 2′ apart	1	19	15	0	11	18	9	10	38	0	One hand hoeing and one bullock hoeing.
														N.B.—Four waterings on 14th September 1918, 10th October 1918, 18th October 1918 and 4th November 1918.
13														
13	1	Red local maize.	Kera behind the country plough	1	18	13	18	11	$26\frac{1}{2}$	8	39	37	$31\frac{9}{16}$	No hoeing.
	2		Lines 2′ apart	1	18	12	2	9	16	7	10	30	$21\frac{1}{16}$	Bullock hoeing one.
	3		Kera behind the country plough	1	18	17	0	12	13	9	22	40	$8\frac{7}{16}$	No hoeing.
	4		Lines 2′ apart	1	18	13	0	8	17	6	24	27	$31\frac{9}{16}$	Bullock hoeing one.
														N.B.—Five waterings on 7th September 1918, 17th September 1918, 30th September 1918, 10th October 1918 and 30th October 1918.
16														
19	1	Red local maize.	Kera behind the country plough	2	3	6	2	3	7	2	20	9	$12\frac{1}{16}$	No hoeing.
	2		Lines 2′ apart	2	3	17	34	9	23	7	21	28	0	Bullock hoeing one.
	3		Kera behind the country plough	2	3	14	25	9	5	6	34	25	$19\frac{9}{16}$	No hoeing.
	4		Lines 2′ apart	2	3	15	2	7	32	6	3	22	$24\frac{3}{16}$	Bullock hoeing one.
														N.B.—Five waterings on 18th September 1918, 1st October 1918, 12th October 1918 30th October 1918, and 22nd November 1918.
16														
20	1	Red local maize.	Kera behind the country plough	2	4	9	12	5	15	4	3	14	$32\frac{1}{16}$	No hoeing.
	2		Lines 2′ apart	2	4	10	21	6	15	4	38	18	0	Bullock hoeing one.
	3		Kera behind the country plough	2	4	9	19	5	28	4	17	16	$3\frac{9}{16}$	No hoeing.
	4		Lines 2′ apart	2	4	12	28	6	29	5	7	18	$32\frac{13}{16}$	Bullock hoeing one.
														N.B.—Five waterings on 18th September 1918, 1st October 1918, 12th October 1918, 30th October 1918 and 22nd November 1918.
20														
5	1	Red local maize.	Kera behind the country plough	1	16	8	9	5	30	4	28	20	$35\frac{9}{16}$	No hoeing.
	2		Lines 2′ apart	1	16	8	16	5	5	4	8	18	$26\frac{1}{16}$	Bullock hoeing one.
	3		Kera behind the country plough	1	16	7	14	5	24	4	20	20	0	No hoeing.
	4		Lines 2′ apart	1	16	6	39	4	19	3	22	15	$31\frac{9}{16}$	Bullock hoeing one.
														N.B.—Four waterings on 19th September 1918, 30th September 1918, 12th October 1918 and 30th October 1918.
			Average yield.											
	1		Kera behind the country plough	20	0	...	...	...	...	67	7	26	$34\frac{3}{4}$	
	2		Lines 2′ apart	20	0	...	...	...	...	64	$9\frac{1}{2}$	25	$27\frac{3}{4}$	

Statement No. 6.

OUTTURN OF SENJI (MELILOTUS PARVIFLORA) GROWN IN SQUARE 27, AREA C (ROTATION SERIES), 1918-19.

No. of square and plot.	No. of sub-plot.	Area.		Actual outturn.			Outturn per acre.			Remarks.
		Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
27 C-2	1	4	0	75	2	0	150	4	0	After maize sown by kera.
	2	4	0	87	20	0	175	0	0	After maize sown in lines.
	3	4	0	92	9	0	184	18	0	After maize sown by kera.
	4	4	0	74	0	0	148	0	0	After maize sown in lines.

Dates of waterings—3rd October 1918, 18th October 1918, 3rd November 1918, 5th December 1918, 31st December 1918 and 24th January 1919.
Date of sowing—22nd September 1918.
Date of harvesting—Plot 1st -From 14th February to 20th February 1919.
Plot 4th— ditto ditto.
Plot 2nd—From 21st February to 27th February 1919.
Plot 3rd—From 21st February to 27th February 1919.

Statement No. 7.

RESULTS OF CULTURAL EXPERIMENTS WITH WHEAT GROWN IN SQUARE 27, AREA D, RABI 1918-19.

No. of square and plot.	Sub-plot.	Variety.	Treatment.	Area in acres.	Actual outturn.						Outturn per acre.						Dates of waterings.	Remarks.
					Grain.			*Bhusa.*			*Grain.*			*Bhusa.*				
					Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.		
D 1	a	Punjab type 11.	Ploughed 6″ deep with Raja plough.	¼	5	2	8	8	9	8	20	10	0	32	38	0	17th February 1919. 26th March 1919.	
	b		Ditto ditto	¼	6	8	0	10	4	0	24	32	0	40	16	0	25th January 1919. 17th February 1919. 26th March 1919.	
D 2	a		Ploughed 6″ deep and then stirred.	¼	4	10	0	6	10	0	17	0	0	25	0	0	17th February 1919. 26th March 1919.	
	b		Ditto ditto	¼	4	4	8	6	21	8	16	18	0	26	6	0	25th January 1919. 17th February 1919. 26th March 1919.	
D 3	a		Ploughed 6″ deep ...	¼	3	17	0	5	9	0	13	28	0	20	36	0	17th February 1919. 26th March 1919.	
	b		Ditto ...	¼	4	7	0	7	14	0	16	28	0	29	16	0	25th January 1919. 17th February 1919. 26th March 1919.	
D 4	a		Ploughed 6″ deep and then stirred.	¼	5	23	0	9	21	0	22	12	0	38	4	0	17th February 1919. 26th March 1919.	
	b		Ditto ditto	¼	6	9	0	10	34	0	24	36	0	43	16	0	25th January 1919. 17th February 1919. 26th March 1919.	
D 5	a		Ploughed 6″ deep ...	¼	6	4	8	11	18	8	24	18	0	45	34	0	17th February 1919. 26th March 1919.	
	b		Ditto ...	¼	6	1	0	11	19	0	24	4	0	45	36	0	25th January 1919. 17th February 1919. 26th March 1919.	
D 6	a		Ploughed 9″ deep ..	¼	4	16	0	6	2	0	17	24	0	24	8	0	17th February 1919. 26th March 1919.	
	b		Ditto ...	¼	5	8	0	7	35	0	20	32	0	31	20	0	25th January 1919. 17th February 1919. 26th March 1919.	
D 7	a		Ploughed 6″ deep ...	¼	2	31	0	5	12	0	11	4	0	21	8	0	17th February 1919. 26th March 1919.	
	b		Ditto ...	¼	4	5	0	7	31	0	16	20	0	31	4	0	25th January 1919. 17th February 1919. 26th March 1919.	
D 8	a		Ploughed 9″ deep ...	¼	6	27	0	12	35	0	26	28	0	51	20	0	17th February 1919. 26th March 1919.	
	b		Ditto ...	¼	6	21	0	12	16	0	26	4	0	49	24	0	25th January 1919. 17th February 1919. 26th March 1919.	

(*a*) Denotes two waterings while (*b*) denotes three waterings.

Ploughings 4
Harrowings 4
Sohagaings 4
Surface harrowings 4
Date of sowing --8th October 1918.
Date of harvesting—30th April to 3rd May 1919.

Average yield per acre

	Mds.	Srs.	Chks.
Raja plough 6″ deep ..	18	34	8
Raja plough and deeply stirred with desi plough ...	20	6	8
Raja plough 6″ deep .	19	1	8
Deeply ploughed 9″ ...	22	32	0

Statement No. 7a.

WEIGHMENT OF CHARI AND MAIZE GROWN IN MIXTURE, SQUARE 27, AREA D, DURING KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Area in acres.	Actual outturn of dry stalks.		Yield of dry stalks per acre.		Remarks.
			Maunds.	Seers.	Maunds.	Seers.	
27/D	1	½	44	29	89	18	
	2	½	17	9	34	18	Date of sowing—22nd April 1918.
	3	½	19	5	38	12	Surface harrowing ... 1
	4	½	47	7	94	14	No. of waterings ... 3
	5	½	47	6	94	12	Date of harvesting—4th July 1918.
	6	½	19	3	38	6	
	7	½	18	27	37	14	
	8	½	48	28	97	16	

Statement No. 8.

OUTTURN OF MAIZE GROWN IN THE MANURIAL BLOCK, AREA E., SQUARE 27, KHARIF 1918.

No. of plot.	Variety.	Treatment.	Area in acre.	Weight of fresh cobs.			Weight of dry cobs.			Weight of dry stables.			Weight of grain			Yield of grain per acre.			Dates of waterigs are :—	Remarks.	
				Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
1	Red local maize.	Farmyard manure at 5 tons per acre ...	1/10th of an acre each.	5	19	0	2	30	0	6	5	0	1	39	0	19	30	0	13th September 1918.	Crows did some damage as the crop was late.	
2		Sodium nitrate at 310 lbs. per acre ...		5	33	0	4	7	0	6	11	0	3	4	0	31	0	0			
3		Control ...		5	15	0	3	4	0	5	10	0	2	10	0	22	20	0	22nd September 1918.		
4		Bonemeal at 2 cwt. 76 lbs. per acre ...		4	5	0	2	36	0	4	25	0	2	3	0	20	30	0		Ploughings 3	
5		Potassium sulphate at 90 lbs. per acre ...		4	20	0	2	18	0	4	29	0	1	32	0	18	0	0	3rd October 1918.		
6		Control ...		4	29	0	3	0	0	4	6	0	2	5	0	21	10	0		Harrowings ... 5	
7		Bonemeal at 2 cwt. 76 lbs. per acre, Sodium nitrate at 310 lbs. per acre, Potassium sulphate at 90 lbs. per acre.		6	3	0	4	5	8	5	3	0	3	1	8	30	15	0	28th October 1918.	Sohagaings ... 3	
8		Control ...		4	13	0	2	34	0	3	23	0	2	5	0	21	10	0		Hoeings ... 5	
9		Farm yard manure at 5 tons per acre ...		4	28	0	3	14	0	3	38	0	2	14	0	23	20	0			
10		Sodium nitrate at 310 lbs. per acre ...		5	34	0	4	5	0	4	36	0	3	1	0	30	10	0		Waterings ... 4	
11		Control ...		2	28	0	1	33	0	2	39	0	1	13	0	13	10	0			
12		Bonemeal at 2 cwt. 76 lbs. per acre ...		3	10	0	2	1	8	2	38	0	1	18	8	14	25	0			
13		Potassium sulphate at 90 lbs. per acre. ..		2	15	0	1	19	8	2	39	0	1	2	8	10	25	0			
14		Control ...		3	8	0	1	36	0	3	6	0	1	17	0	14	10	0			
15		Bonemeal at 2 cwt. 76 lbs. per acre, Sodium nitrate at 310 lbs per acre, Potassium sulphate at 90 lbs per acre ...		3	35	0	2	23	0	4	15	0	2	0	0	20	0	0			
16		Control ...		4	12	0	1	26	0	3	39	0	1	10	0	17	20	0			

Date of sowing—19th August 1918.

Date of harvesting—3rd December 1918.

Average Outturn per acre

	Mds.	Seers.
Farm yard manure	21	25
Sodium nitrate	30	25
Bonemeal	17	27½
Potassium sulphate	14	12½
Sodium nitrate *plus* Bonemeal *plus* Potassium sulphate	25	7½
Control	17	20

Statement No. 9.

OUTTURN OF BARLEY GROWN IN SQUARE 27, AREA F_1, DURING RABI 1918-19.

No. of plot.	Name of crop.	Treatment.	Area in acre.	Actual outturn.						Outturn per acre.						Remarks.
				Grain.			*Bhusa.*			*Grain.*			*Bhusa.*			
				Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
1	Lyallpur Barley ...	Manures applied to previous Kharif crop.	1/10	1	27	0	1	33	0	16	30	0	18	10	0	
2	Ditto ...		1/10	1	31	0	1	22	0	17	30	0	15	20	0	
3	Ditto ...		1/10	1	8	0	1	8	0	12	0	0	12	0	0	
4	Ditto ...		1/10	0	32	0	0	33	0	8	0	0	8	10	0	
5	Ditto ...		1/10	0	28	0	0	29	0	7	0	0	7	10	0	
6	Ditto ...		1/10	0	33	0	0	36	0	8	10	0	9	0	0	
7	Ditto ...		1/10		29	0	1	20	0	17	10	0	15	0	0	
8	Ditto ...		1/10	0	35	0	1	8	0	8	30	0	12	0	0	
9	Ditto ...		1/10	1	1	0	1	16	0	10	10	0	14	0	0	
10	Ditto ...		1/10	0	29	8	0	39	8	7	15	0	9	35	0	
11	Ditto ...		1/10	0	20	0	0	25	0	5	0	0	6	10	0	
12	Ditto ...		1/10	0	23	8	0	27	8	5	35	0	6	35	0	
13	Ditto ...		1/10	0	27	0	0	31	0	6	30	0	7	30	0	
14	Ditto ...		1/10	0	26	0	0	26	0	6	20	0	6	20	0	
15	Ditto ...		1/10	2	2	0	1	38	0	20	20	0	19	20	0	
16	Ditto ...		1/10	0	22	0	0	20	0	5	20	0	5	0	0	

Ploughings 2

Harrowings 1

Sohagas 2

Surface harrowings 3

Date of sowing—14th December 1918.

Date of harvesting—17th April 1919.

Waterings—14th February 1919, 4th March 1919, 26th March 1919.

Statement No. 10.

OUTTURN OF MAIZE GROWN IN THE MANURIAL BLOCK, AREA F 2, SQUARE 27, KHARIF 1918.

No. of plot.	Variety.	Treatment.	Area in acre.	Weight of fresh cobs.			Weight of dry cobs.			Weight of dry stables.			Weight of grain.			Yield of grain per acre.			Date of waterings.	Remarks.
				Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.		
1	Red local maize.	Farmyard manure at 5 tons per acre.	One-tenth of an acre each.	4	17	0	2	30	0	5	33	0	1	38	0	19	20	0		Crows did damage as the crop was late.
2		Sodium nitrate at 310 lbs per acre.		6	18	0	4	27	0	6	24	0	3	19	0	34	30	0		
3		Control ...		5	16	0	3	11	0	5	1	0	2	18	0	24	20	0		
4		Bonemeal at 2 cwt. 76 lbs. per acre.		4	31	0	3	13	0	4	20	0	2	20	0	25	0	0	13-9-18	
5		Potassium sulphate at 90 lbs. per acre.		4	22	0	2	38	0	4	29	0	2	8	0	22	0	0		
6		Control		4	12	0	2	33	0	4	6	0	2	2	0	20	20	0	22-9-18	
7		Bonemeal at 2 cwt. 76 lbs. per acre, sodium nitrate at 310 lbs. per acre, Potassium sulphate at 90 lbs. per acre.		4	6	0	2	28	8	4	28	0	2	0	0	20	0	0	3-10-18	
8		Control ...		4	10	0	2	39	0	4	23	0	2	7	0	21	30	0	26-10-18	
9		Farmyard manure at 5 tons per acre.		4	0	0	2	24	0	4	11	0	1	37	0	19	10	0		
10		Sodium nitrate at 310 lbs. per acre.		4	3	0	2	22	8	4	5	0	1	34	0	18	20	0		
11		Control ...		2	15	0	1	15	0	3	9	0	1	0	0	10	0	0		
12		Bonemeal at 2 cwt. 76 lbs. per acre.		3	3	0	1	35	8	3	30	0	1	15	0	13	30	0		
13		Potassium sulphate at 90 lbs. per acre.		3	1	0	1	36	8	3	27	0	1	14	8	13	25	0		
14		Control ...		3	27	0	1	23	0	4	9	0	1	6	0	11	20	0		
15		Bonemeal at 2 cwt. 76 lbs. per acre. Sodium nitrate at 310 lbs. per acre, Potassium sulphate at 90 lbs. per acre.		5	5	0	3	5	0	5	39	0	2	20	0	25	0	0		
16		Control ...		3	2	0	1	30	0	3	23	0	1	12	0	13	0	0		

Ploughings	3
Harrowings	4
Sohagaings	2
Hoeings	5

Date of sowing,—19th August 1918.

Date of harvesting,—3rd December 1918.

Average outturn per acre.

	Mds.	Srs.
Farmyard manure	19	15
Sodium nitrate	26	25
Potassium sulphate	17	32½
Sodium nitrate + Potassium sulphate + Bonemeal	22	20
Control	16	35
Bonemeal...	19	25

Statement No. II.

OUTTURN OF DRY SENJI HAY (MELILOTUS PARVIFLORA) GROWN IN SQUARE 27, AREA F_2, 1918-19.

No. of square and plot.	No. of sub-plot.	Area. Kanal.	Area. Marla	Actual outturn Mds. Srs. Chks.	Outturn per acre. Mds. Srs. Chks.	Dates of watering.	Remarks.
27 F_2	1	0	16	4 9 0	42 10 0	28th October 1918 .. 4th December 1918. 29th December 1918. 12th February 1919. 4th March 1919.	No manure was applied to this crop.
	2	0	16	5 0 0	50 0 0		
	3	0	16	5 28 0	55 30 0		
	4	0	16	5 23 0	55 30 0		
	5	0	16	5 14 0	53 20 0		
	6	0	16	4 30 0	47 20 0		
	7	0	16	4 6 0	41 20 0		
	8	0	16	5 16 0	54 0 0		
	9	0	16	5 22 0	55 20 0		
	10	0	16	4 3 0	40 30 0		
	11	0	16	4 10 0	42 20 0		
	12	0	16	4 23 0	45 30 0		
	13	0	16	4 30 0	47 20 0		
	14	0	16	5 14 0	53 20 0		
	15	0	16	4 28 0	47 0 0		
	16	0	16	4 23 0	45 30 0		

Date of sowing,—3rd October 1918.

Date of harvesting,—19th March 1919 to 20th March 1919.

Weighments were done on 28th of Macrh 1919 after drying.

Manures applied to the previous crop of maize were as fellows:—

Plots 1 and 9 ... ... Farmyard manure.

Plots 2 and 10 ... ... Sodium nitrate.

Plots 3, 6, 8, 11, 14, 16 ... ... No manure.

Plots 4 and 12 ... ... Bonemeal.

Plots 5 and 13 ... ... Potassium Sulphate.

Plots 7 and 15 ... ... Na No_3 Bonemeal and K_2 So_4.

Statement No. 12.

OUTTURN OF 4-F AMERICAN COTTON GROWN IN SQUARE 26, KHARIF 1918.

No. of plot.	No. of sub-plot.	Treatment.	Area in acres.	Actual outturn.			Outturn per acre.			Dates of waterings.	Irrigation in inches.			Remarks.
				Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.		Before ridging.	After ridging.	Total.	
											Inches.	Inches.	Inches.	
A2/1	a1	Drilled on flat	¼	0	10	10½	1	2	10	10th June 1918, 8th July 1918, 10th August 1918, 21st August 1918, 11th September 1918, 22nd September 1918, 3rd October 1918, 2nd November 1918.	5·96	16·06	22·02	Ploughings ... 8
	a2	Drilled on flat, ridged afterwards	¼	0	12	2	1	8	8		5·96	11·66	17·62	
	b1	Drilled on flat	¼	0	15	3	1	20	12		5·96	19·31	25·27	
	b2	Drilled on flat, ridged afterwards	¼	0	17	12	1	31	0		5·96	12·45	18·41	Harrowings ... 6
A2/2	a1	Drilled on flat	¼	0	16	4	1	25	0	7th May 1918, 10th June 1918, 27th July 1918, 14th August 1918, 11th September 1918, 22nd September 1918, 3rd October 1918, 2nd November 1918.	5·77	14·85	20·62	Sohagaings ... 10
	a2	Drilled on flat, ridged afterwards	¼	0	26	4	2	25	0		5·77	11·48	17·25	Hoeings in case of A2/2 & 3 ... 12
	b1	Drilled on flat	¼	0	14	8	1	18	0		5·77	18·95	24·72	
	b2	Drilled on flat, ridged afterwards	¼	0	21	12	2	7	0		5·77	13·69	19·46	Hoeings in case of A2/1 ... 11
A2/3	a1	Drilled on flat	¼	0	28	2	2	32	8	7th May 1918, 10th June 1918, 27th July 1918, 14th August 1918, 11th September 1918, 22nd September 1918, 3rd October 1918, 2nd November 1918.	5·55	14·57	20·12	Date of sowing.—9th April 1918.
	a2	Drilled on flat, ridged afterwards	¼	0	37	14	3	31	8		5·55	12·54	18·09	Picking commenced on 25th October 1918 and finished on 6th February 1919.
	b1	Drilled on flat	¼	0	30	15	3	3	12		5·55	17·41	22·96	
	b2	Drilled on flat, ridged afterwards	¼	1	9	6	4	37	8		5·55	13·92	19·47	
		Average yield per acre.												
	1	Drilled on flat	1½	2	35	10½	1	37	1⅔					
	2	Drilled on flat, ridged afterwards	1½	4	5	2	2	30	1⅓					

Statement No. 13.

OUTTURN OF 4-F AMERICAN COTTON, KHARIF 1918.

No. of square and block.	No. of plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Irrigation in inches with dates. Irrigation in inches.	Irrigation in inches with dates. Dates of irrigation.	Hoeing with dates to drilled portion.	Hoeing with dates to broadcast portion.	Remarks.
32/C	1	a	Sown broadcast (2 waterings in June and July).	4	0	3	25	13	7	11	10	4·42	21st June 1918 ...	Drill Harrow—	Country plough once 3rd September 1918.	
												2·40	8th July 1918 ...	28th May 1918 ...		
												2·71	17th August 1918.	23rd June 1918.		
...	...	b	Drilled in lines 3′ apart (2 waterings in June and July).	4	0	4	19	9	8	39	2	3·58	10th September 1918	Horse Hoe—		
												2·72	26th September 1918.	10th July 1918.		
												2·47	9th October 1918.	20th August 1918.		
														1st September 1918.		
														17th July 1918.		
32/C	2	a	Drilled in lines 3′ apart (3 waterings in May, June and July).	4	0	3	35	1	7	30	2	3·37	25th May 1918 ...	Drill Harrow—	Country plough once 3rd September 1918.	
												3·75	21st June 1918 ...	28th May 1918.		
												2·51	8th July 1918 ...	23rd June 1918.		
...	...	b	Sown broadcast (3 waterings in May, June and July).	4	0	3	18	10	6	37	4	2·55	17th August 1918 ...	Horse Hoe—		
												2·63	10th September 1918	10th July 1918.		
												2·32	26th September 1918	17th July 1918.		
												2·20	9th October 1918 ...	20th August 1918.		
														1st September 1918.		
32/C	3	a	Sown broadcast (no waterings in May and June, first watering given in July).	4	0	3	35	15	7	31	14	3·46	7th July 1918 ...	Drill Harrow—	Country plough one 3rd September 1918.	
												2·74	17th August 1918 ...	28th May 1918.		
												2·72	10th September 1918	23rd June 1918.		
...	...	b	Drilled in lines 3′ apart (no waterings in May and June, first watering in July).	4	0	3	19	0	6	38	10	2·13	26th September 1918	Horse Hoe—		
												1·87	9th October 1918 ...	10th July 1918.		
														17th July 1918.		
														20th August 1918.		
														1st September 1918.		

32/C	4	a	Drilled in lines 3′ apart (2 waterings in June and July).	4	0	4	8	5	8	16	10	4·25 3·11 2·23 2·32 2·60 1·72	21st June 1918 ... 7th July 1918 ... 18th August 1918 ... 12th September 1918 26th September 1918 9th October 1918 ...	Drill Harrow— 28th May 1918. 23rd June 1918. Horse Hoe— 10th July 1918. 17th July 1918. 19th August 1918. 1st September 1918.	Country plough once on 2nd September 1918.
...	...	b	Sown broadcast (2 waterings in June and July).	4	0	3	35	6	7	30	12				
32/C	5	a	Sown broadcast (3 waterings in May, June and July).	4	0	2	27	4	5	14	8	2·90 3·81 2·82 2·62 3·59 2·96 2·24	25th May 1918 ... 21st June 1918 ... 7th July 1918 ... 18th August 1918 ... 12th September 1918 26th September 1918 9th October 1918.	Drill Harrow— 28th May 1918. 23rd June 1918. Horse Hoe— 10th July 1918. 17th July 1918. 19th August 1918. 1st September 1918.	Country plough once on 2nd September 1918.
...	...	b	Drilled in lines 3′ apart (3 waterings in May, June and July).	4	0	4	21	8	9	3	0				
32/C	6	a	Drilled in lines 3′ apart (no watering in May and June, first watering in July only).	4	0	5	37	2	11	34	4	3·45 3·49 3·25 3·50 30·7	7th July 1918 ... 18th August 1918 ... 12th September 1918 26th September 1918 9th October 1918 ...	Drill Harrow— 28th May 1918. 23rd June 1918. Horse Hoe— 10th July 1918. 17th July 1918. 19th August 1918. 1st September 1918.	Country plough once on 2nd September 1918.
...	...	b	Sown broadcast (no watering in May, June and first watering in July only).	4	0	4	24	1	9	8	2				

Rainfall in inches with dates during its growth.

Inches	*Date.*
·09	18th June 1918.
·72	14th July 1918.
·10	15th July 1918.
2·13	21st August 1918.
1·16	26th August 1918.
·35	3rd September 1918.
·22	28th September 1918.
·16	7th October 1918.
·07	13th December 1918.
·36	15th December 1918.
·18	27th January 1919.
·72	28th January 1919.
·37	29th January 1919.

Average yield per acre calculated on yield per acre.

	Mds.	Sr.	Ch.
Two waterings	8	4	8
Three waterings	7	11	3
No watering till July (one watering)	8	38	1

Ploughings 2
Harrowings 6
Sohagaings 6

Date of sowing,—28th, 29th April 1918

Picking began on 3rd November 1918 and finished on 3rd February 1919.

Average outturn per acre—

	Mds.	*Sr.*	*Ch.*
Lines ...	8	33	8½
Broadcast	7	15	11

Statement No. 14.

SHOWING RESULTS OF SOWING COTTON IN LINES *VERSUS* BROADCAST WITH TENANTS AT LYALLPUR AGRICULTURAL STATION, KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Broadcast. Area. Kanals.	Marlas.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	No. of square and plot.	No. of sub-plot.	Lines. Area. Kanals.	Marlas.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	Remarks.
								4-F.												
6/5	2	1	18	2	2	1	8	25	8	6/5	4	1	18	3	33	3	16	5	...	Broadcast received five waterings on 25th June 1918, 26th July 1918, 20th August 1918, 16th September 1918 and 29th September 1918 and intercultured once with desi plough on 31st August 1918.
6/6	2	1	19	1	9	7	5	2	13	6/6	4	1	19	2	21	13	10	17	11	Line plots received four waterings on 10th July 1918, 20th August 1918, 16th September 1918 and 29th September 1918 and hoed 3 times on 26th June 1918, 19th July 1918 and 3rd September 1918.
	Total ...	3	17	3	11	8	6	33	4	...	...	3	17	6	15	...	13	9	14	
	Average outturn calculated on yield per acre						6	34	2½	...	...	...	...	...	...	...	13	11	5½	
								Rosea 87.												
6/5	1	1	18	2	14	2	9	36	5	6/5	3	1	18	3	18	10	14	23	13	Broadcast received six waterings on 12th May 1918, 25th June 1918, 10th July 1918, 20th August 1918, 16th September 1918 and 29th September 1918 and intercultured once with desi plough on 5th September 1918.
6/6	1	1	19	1	23	2	6	18	15	6/6	3	1	19	3	18	2	14	6	10	Lines plots received five waterings on 12th May 1918, 25th June 1918, 20th August 1918, 16th September 1918, and 29th September 1918 and hoed 5 times on 15th May 1918, 16th May 1918, 27th June 1918, 15th July 1918 and 17th July 1918.
	Total ...	3	17	3	37	4	8	6	12	...	...	3	17	6	36	12	14	15	5	
	Average outturn per acre calculated on yield per acre						8	7	10	...	...	...	...	...	...	...	14	15	3½	

Statement No. 15.

RESULTS OF RIDGING *VERSUS* NO RIDGING WITH MAIZE IN LINES IN TENANTS AREA, KHARIF 1918.

No. of Square and plot.	No. of sub-plot.	Variety.	Treatment.	Area.		Weight of fresh cobs.			Weight of dry cobs.			Weight of grain.			Weight of grain per acre.			Remarks
				Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
6/15	1	Red local maize	Drilled and no ridging done	1	17	15	1	0	9	15	0	7	11	0	31	18	6	Bullock hoeings two, waterings 5 on 16th September 1918, 29th September 1918, 10th October 1918, 19th October 1918 and 4th November 1918.
	2		Drilled and ridged after 1st irrigation	1	17	13	8	0	9	25	0	8	4	0	35	1	1	Ridges made on 23rd September 1918, in plots 2 and 4.
	3		Drilled and no ridging done	1	17	13	23	0	10	16	0	8	29	0	37	29	3	
	4		Drilled and ridged after 1st irrigation	1	17	13	28	0	10	18	0	8	33	0	38	6	8	
17/19	1	Red local maize	Drilled and no ridging done	2	4½	20	26	0	12	7	0	9	21	0	34	9	14	Bullock hoeings three, waterings 5 on 14th September 1918, 28th September 1918, 10th October 1918, 18th October 1918 and 4th November 1918.
	2		Drilled and ridged after 1st irrigation	2	4	23	2	0	15	9	0	12	9	0	43	38	3	Ridges made on 18th September 1918, in plots 2 and 4.
	3		Drilled and no ridging done	2	4½	19	39	0	12	23	0	10	0	0	35	38	3	
	4		Drilled and ridged after 1st irrigation	2	4½	17	15	0	11	19	0	8	7	0	29	15	12	
			Average yield per acre.															
			Drilling but no ridging	8	3	...	...	...	...	...	...	35	21	0	34	34	13	
			Drilling and ridging after first watering ...	8	3	...	...	...	...	...	...	37	13	0	36	25	8	

Statement No. 16.

RESULTS OF HYDRAULIC EXPERIMENTS WITH FARM SELECTED BROAD LEAF SANGUINEUM COTTON GROWN IN SQUARE 10, KHARIF 1918-19.

No. of square and plot.	Sub-Plot.	Treatment.	Area, Kanals.	Area, Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre, Maunds.	Outturn per acre, Seers.	Irrigation in inches with dates. For sowing (*Rauni*). 17th April '18	After sowing. 22nd June '18.	27th July '18	15th Sept. '18	1st October '18.	15th October '18	Total.	Total irrigation in inches.	Remarks.
10 B 1*a*	1	Ordinary cultivation with 8 kiaries per acre cotton drilled in lines 2′ 4″ apart.	1	18	2	15	10	0	3·57	..	2·60	2·70	2·35	2·50	10·15	13·72	Average yield per acre calculated from yield per acre.
	2		1	18·71	2	9	9	8	2·97	...	2·90	2·30	2·80	2·80	11·30	14·27	
	3		2	0	2	32	11	8	2·97	...	2·50	2·85	2·50	2·50	10·35	13·32	Mds. Srs.
	4		2	0	2	23¾	10	15	3·27	...	2·65	2·80	2·50	2·50	10·45	13·72	In lines ... 10 7¾
10 B 2*a*	1	Ordinary cultivation with 8 kiaries per acre cotton sown broadcast.	2	0	2	2½	8	10	2·97	2·97	2·0	2·65	2·30	2·80	9·75	12·72	Mds. Srs.
	2		1	19	1	23⅕	6	20¼	2·97	2·97	1·80	2·45	2·70	2·70	9·65	12·62	Average yield ... 8 4¾
	3		1	15·3	1	21¾	7	2⅞	3·17	2·47	2·30	2·60	2·80	2·60	10·30	13·47	
	4		2	0	1	25½	6	22	3·17	2·28	1·80	2·25	2·80	2·80	9·65	12·82	

Plowings—Raja 1.
Country 1.
Harrowings—Spring toothed harrow 1, Barharrow 1,
Horse hoe 2.
Sohagaings 4.
Hoeings— { B 1*a* Bar harrow 1, Drill harrow 3, horse hoe 3.
{ B 2*a* Bar harrow 1, country plow 1.
Date of sowing—20th April 1918.
Picking began on 19th September 1918 and finished on 6th February 1919.

Statement No. 17.

RESULTS OF HYDRAULIC EXPERIMENTS WITH FARM SELECTED PROAD LEAF SANGUINEUM COTTON GROWN IN SQUARE 10, KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Irrigation in inches with dates. For sowing (Rauni) 17th April 1918.	After sowing. 22nd May 1918.	22nd June 1918.	3rd July 1918.	14th August 1918.	15th September 1918.	1st October 1918.	15th October 1918.	Total.	Total up to 3rd July 1918.	Total irrigation in inches.	Remarks.
10 C 1 a	1	Watered in May, June, July	2	0	2	4	8	16	3·57	2·97	2·97	3·30	3·20	3·35	2·80	2·90	21·49	9·24	25·06	
	2	Not watered in May and June... ...	1	12·12	1	35	9	13⅓	3·27	...	...	3·65	2·90	2·80	2·90	2·40	14·65	3·65	17·92	
	3	Watered in May, June, July	1	12·56	1	15	6	30¼	3·17	2·97	2·57	2·70	3·0	2·70	3·0	2·50	19·44	8·24	22·61	
	4	Not watered in May	2	0	1	26	6	24	2·97	...	2·87	3·20	3·10	3·10	3·0	2·90	18·17	6·07	21·14	
10 C 2 a	1	Not watered in May and June	2	0	2	25	10	20	2·97	...	...	3·50	3·60	3·0	2·90	2·60	15·60	3·50	18·57	
	2	Watered in May, June, July	2	0	1	18	5	32	2·97	2·97	2·97	3·20	3·20	3·10	3·0	2·90	21·34	9·14	24·31	
	3	Watered in May	2	0	1	20	6	0	3·27	...	2·97	3·20	3·30	2·70	2·70	2·80	17·67	6·17	20·94	
	4	Watered in May, June, July	1	15·09	1	5	5	5⅝	2·97	2·97	2·97	3·20	3·10	2·60	3·0	2·60	20·44	9·14	23·41	

Average yield per acre from yields per acre—

Waterings.	Mds.	Seers.
1	9	36¾
2	6	12
3	6	20⅞

Average yield per acre calculated from the area under crop—

Waterings	Area. Kanals	Area. Marlas	Yield. Mds.	Yield. Seers.	Yield per acre. Mds.	Yield per acre. Seers.
1 ...	3	12·12	4	20	9	39⅓
2 ...	4	0	3	6	6	12
3 ...	7	7·65	6	2	6	22¼

Ploughings—

Raja	1
Country	1
Harrowings—Spring toothed harrow and horse hoe	2
Sohagaings	4
Hoeings—Bar harrow	1
Drill harrow	3
Horse hoe	3

Date of sowing,—21st April 1918.

Picking began on 19th September 1918, finished on 6th February 1919.

Average yield per acre calculated from yields per acre—

Waterings.	Mds.	Seers.
1	9	36¾
... ...	6	12
3	6	20⅞

Statement No. 18.

RESULTS OF HYDRAULIC EXPERIMENTS WITH WHEAT GROWN IN SQUARE 10, RABI 1918-19 (EARLY SOWN).

No. of square and plot.	No. of sub-plot.	Treatment.	Area.		Actual Outturn.				Outturn Per Acre.				Irrigation in inches with Dates.					Total Irrigation in inches including Rauni.	Remarks.
					Grain.		Straw.		Grain.		Straw.		For sowing (Rauni)	After sowing.					
			Kanals.	Marlas.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	2nd November 1918.	3rd January 1919	14th February 1919.	20th March 1919.	Total.		
10 A a 1	1	2 kiaries, ordinary cultivation surface harrowing, 3 waterings.	1	19·88	7	17½	15	32	30	21⅝	63	16	4·73	3·10	2·26	2·41	7·77	12·50	This plot has got very rich soil on account of its proximity to the village.
	2	2 kiaries, ordinary cultivation surface harrowing, 2 waterings.	1	19·91	6	32	18	11	27	10 1/16	73	11	3·44	...	4·13	2·68	6·81	10·25	
	3	2 kiaries, ordinary cultivation surface harrowing, 3 waterings.	2	·012	7	24½	19	39	30	14⅜	79	27	3·67	2·69	2·93	2·41	8·03	11·7	
	4	2 kiaries, ordinary cultivation surface harrowing, 2 waterings.	2	0	7	31½	17	19	31	6	69	36	3·57	...	2·96	2·78	5·74	9·31	
10 A b 1	1	2 kiaries, ordinary cultivation surface harrowing, 3 waterings.	1	19 97	7	3¾	15	7	28	15 13/16	60	30	4·27	2·80	2·08	2·41	7·29	11·56	
	2	2 kiaries, ordinary cultivation surface harrowing, 2 waterings.	2	0·09	6	15¾	11 *with kallar patch*	10 *kallar patch*	25	20 11/16	44	36	4·17	...	2·73	2·41	5·14	9·31	
	3	2 kiaries, ordinary cultivation surface harrowing, 3 waterings.	1	19·19	6	23	13	5	26	34	53	23	4·07	2·75	2·02	2·41	7·18	11·25	
	4	2 kiaries, ordinary cultivation surface harrowing, 2 waterings.	2	1·2	6	5½	12	15	23	33⅓	48	2	3·97	...	2·86	2·50	5·36	9·33	

Average outturn per acre from calculated outturn per acre.—

3 Waterings.

Mds.	Srs.	Chs.
29	1	7

2 Waterings.

With kallar patch.			Without kallar patch.		
Mds.	Srs.	Chs.	Mds.	Srs.	Chs.
26	37	10	27	14	0

Average outturn per acre from actual area under crop.—

3 Waterings.

Mds.	Srs.	Chs.
28	34	13

2 Waterings.

With kallar patch.			Without kallar patch.		
Mds.	Srs.	Chs.	Mds.	Srs.	Chs.
26	36	11	27	13	2

Ploughings—Raja	...	1
Country	...	2
Harrowings—Horse hoe	...	3
Harrow ...	...	3
Sohagaings ...	..	4

No. of surface harrowings and weedings. One to sub-plots 2 and 4 and 3 to sub-plots 1 and 3 in each field.

Date of sowing,—10th November 1918.
Date of harvesting,—24th, 25th April 1919.

Statement No. 19.

RESULTS OF HYDRAULIC EXPERIMENTS WITH LATE SOWN WHEAT GROWN IN SQUARE 10, RABI 1918-19.

No. of square and plot.	No. of sub-plot.	Treatment.	Area.		Actual outturn.				Outturn per acre.				Irrigation in inches with dates.					Remarks.
					Grain.		Straw.		Grain.		Straw.			After sowing.				
			Kanals.	Marlas.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	For Rauni 26th November 1918.	22nd January 1919.	14th February 1919.	27th March 1919.	Total.	Total irrigation in inches.	
10 A 2 a	1	2 Kiaries, ordinary cultivation, surface harrowing, 3 waterings.	2	0	5	16¾	9	13	21	27	37	12	3·61	2·30	2·02	2·59	6·91	10·52	Soil of this plot is richer than that of the other plots, being near the village.
	2	2 Kiaries, ordinary cultivation, surface harrowing, 2 waterings.	2	0	5	13¼	9	32	21	13	39	8	3·52	...	2·52	2·59	5·11	8·63	
	3	2 Kiaries, ordinary cultivation, surface harrowing, 3 waterings.	2	0	6	12¾	9	15	25	11	37	20	3·21	2·20	1·58	2·59	6·37	9·58	
	4	2 Kiaries, ordinary cultivation surface harrowing, 2 waterings.	2	0	6	38½	12	16	27	34	49	24	3·21	...	2·66	2·59	5·25	8·46	
			With	*kallar*	*patch*														
	1	2 Kiaries, ordinary cultivation, surface harrowing, 3 waterings.	2	0	5	19¼	8	37	21	37	35	28	3·34	2·20	1·57	2·59	6·36	9·70	
			Without		*kallar*	*patch*													
			1	13½	5	10¼	8	21	25	11 9/16	41	1							
10 A 2 b			*With*	*kallar*	*patch*														
	2	2 Kiaries, ordinary cultivation, surface harrowing, 2 waterings.	2	0	4	30½	17	31	19	2	71	4	3·57	...	2·75	2·59	5·34	8·91	
			Without		*kallar*	*patch*													
			1	16½	4	14½	17	2	19	4 9/16	74	30							
	3	2 Kiaries, ordinary cultivation, surface harrowing, 3 waterings.	2	0	5	11	8	16	21	4	33	24	3·49	2·39	2·43	2·59	7·41	10·90	
	4	2 Kiaries, ordinary cultivation, surface harrowing, 2 waterings.	2	0	4	20	5	38	18	0	23	32	3·09	...	2·67	2·59	5·26	8·35	

Averege outturn per acre alculated on yield per acre—

	3 Waterings. Mds.	Seers.	Chs.	2 Waterings. Mds.	Seers.	Chs.
With kallar patch ...	... 22	19	12	21	22	4
Without kallar patch	... 23	13	8	21	23	0

Average outturn per acre from actual area under crop—

	3 Waterings. As above Mds.	Seers.	Chs.	2 Waterings. As above Mds.	Sers	Chs.
With kallar patch ...	...					
Without kallar patch	... 23	10	0	21	25½	0

Ploughings	4
Harrowings	7
Sohagaings	6
Surface harrowings	4

Date of sowing—11th December 1918.
Date of harvesting—2nd and 3rd May 1919.

Statement No. 20.

RESULTS OF HYDRAULIC EXPERIMENTS WITH TORIA GROWN IN SQUARE 10, KHARIF 1918 (EARLY SOWN).

No. of square and plot.	Sub-plot.	Treatment.	Area in kanals.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Straw. Maunds.	Straw. Seers.	Straw. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Straw. Maunds.	Straw. Seers.	Straw. Chataks.	Irrigation in inches with dates. Before sowing 8th September 1918.	After sowing. 16th October 1918.	After sowing. 28th November 1918.	After sowing. Total in inches.	Remarks.
10 B 1b	1	Two waterings	2	2	5	0	4	25	0	8	20	0	18	20	0	3·6	2·80	1·73	4·53	
	2	One watering	2	2	8	0	4	22	0	8	32	0	18	8	0	3·4	2·80	*Nil.*	2·80	
	3	Two waterings	2	2	0	0	3	26	0	8	0	0	14	24	0	2·9	2·90	1·73	4·63	
	4	One watering	2	1	39	0	3	39	0	7	36	0	15	36	0	2·4	3·10	*Nil.*	3·10	Suffered more from "tela" than the other 3 sub-plots.
10 B 2b	1	Two waterings	2	1	36	4	4	14	0	7	25	0	17	16	0	2·9	2·77	1·88	4·65	
	2	One watering	2	2	13	0	4	23	0	9	12	0	18	12	0	3·1	2·98	*Nil.*	2·98	
	3	Two waterings	2	2	12	0	4	29	0	9	8	0	18	36	0	3·2	3·09	1·81	4·90	
	4	One watering	2	1	38	0	3	38	0	7	32	0	15	32	0	3·0	3·09	*Nil.*	3·09	Suffered more from "tela" than the other 3 sub-plots.

Average yield per acre.

	Mds.	Seers.	Chataks.
Two irrigations	8	13	4
One irrigation	8	13	0

Ploughings ... ... Raja 1, country 1

Harrowings ... ... 4 (Horse hoe 3 and Bar harrow 1)

Sohagaings 3

Date of sowing—10th September 1918.

Date of harvesting—9th January 1919.

Statement No 21.

RESULTS OF HYDRAULIC EXPERIMENTS WITH TORIA GROWN IN SQUARE 10, KHARIF 1918 (LATE SOWN).

No. of square and plot.	No. of sub-plot.	Treatment.	Area in kanals.	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Straw. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Straw. Maunds.	Seers.	Chataks.	Irrigation in inches with dates. Before sowing 28th September 1918.	After sowing. 24th November 1918.	3rd January 1919.	Total in inches.	Remarks.
10 C 1 b	1	Two waterings	2	2	14	6	6	5	0	9	16	0	24	20	0	3·5″	1·99″	1·80″	3·79″	
	2	One watering	2	2	18	0	6	20	0	9	32	0	26	0	0	3·3″	1·28″	*Nil*	1·28″	
	3	Two waterings	2	2	15½	0	6	21	0	9	22	0	26	4	0	3·5″	1·78″	1·72″	3·50″	
	4	One watering	2	1	38	0	5	1	0	7	32	0	20	4	0	3·35″	1·77″	*Nil*	1·77″	This sub-plot suffered more from "tela" than the other 3 sub-plots.
10 C 2 b	1	Two waterings	2	2	35½	0	7	16	0	11	22	0	29	24	0	3·4″	1·78″	1·38″	3·16″	
	2	One watering	2	2	26½	0	7	12	0	10	26	0	29	8	0	3·25″	1·75″	*Nil*	1·75″	
	3	Two waterings	2	2	16	0	6	8	0	9	24	0	24	32	0	3·25″	2·45″	1·58″	4·03″	
	4	One watering	2	2	2	0	4	21	0	8	8	0	18	4	0	3·3″	2·78″	*Nil*	2·78″	Suffered more from "tela."

Ploughings ... ... Raja 1, Country 1.

Harrowings ... ... Harrow 4, Horse hoe 3. Bar Harrow 1.

Sohagaings 3

Average yield per acre.

	Mds.	Srs.
Two irrigations ...	10	1
One irrigation ...	9	4½

Date of sowing—2nd October 1918.

Date of harvesting—16th February 1919 to 18th February 1919.

Statement No. 22.

HOT WEATHER CULTIVATION *VERSUS* RAIN PLOUGHING IN TENANTS' AREA, RABI 1918-19.

(*a*) HOT WEATHER PLOUGHING.

No. of square.	No. of plot.	Type of wheat.	Area.		Actual outturn.						Outturn per acre.						Remarks.
					Grain.			*Bhusa.*			*Grain.*			*Bhusa.*			
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
6	8	Punjab 11 ...	8	8	17	31	0	29	6	0	16	37	2	27	30	7	
6	10	Do. ...	7	0	14	14	0	24	23	0	16	16	0	29	3	7	
6	12	Do. ...	8	5	16	33	0	33	7	0	16	12	10	32	6	12	
6	14	Do. ...	8	11	19	37	0	46	24	0	18	25	12	43	24	1	

Average yield per acre ... ... Mds. Srs. Chks. 17 4 7

(*b*) RAIN PLOUGHING.

No. of square.	No. of plot.	Type of wheat	Area.		Actual outturn.						Outturn per acre.						Remarks.
					Grain.			*Bhusa.*			*Grain.*			*Bhusa.*			
			Kanals.	Marlas.	Maunds.	Seers	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
6	7	Punjab 11 ...	9	2	21	4	0	40	4	0	18	22	0	35	10	0	
6	9	Do. ...	8	6	13	26	0	30	26	0	13	6	4	29	21	11	
6	11	Do. ...	7	2	17	16	0	29	10	0	19	24	4	32	38	5	
6	13	Do. ...	7	14	12	37	0	22	19	0	13	17	2	23	14	0	

Average yield per acre ... ... Mds. Srs. Chks. 16 6 11

N.B.—Hot weather plots ploughed on 29th May 1918 to 31st May 1918 with Raja plough for the first time.
Rain ploughing plots ploughed on 23rd August 1918 with Raja plough for the first time.

Ploughings 3
Harrowings 4
Waterings ... .. 3 on 7th January 1919, 11th February 1919, 22nd March 1919.
Surface harrowings 3
Date of sowings—17th to 20th November 1918
Date of harvesting—22nd April to 24th April 1919.

Dates of rainfall —

18th June 1918 ... ... 0·09 inches.
14th July 1918 ... ... 0·72 „
15th July 1918 ... ... 0·10 „
21st August 1918 ... . 2·13 „
26th August 1918 .. ... 1·16 „
3rd September 1918 ... ... 0·35 „
28th September 1918 ... ... 0·22 „
7th October 1918 ... ... 0·16 „

Statement No. 23.

SHOWING THE OUTTURN OF TORIA GROWN WITH TENANTS, KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Area. Kanals.	Area. Marlas.	Treatment.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	Remarks.
3 / 12	1 and 3	4	6	Desi plough, broadcasting and Sohagaing ...	4	36	9	9	5	11	
	2 and 4	4	6	Broadcasting, horse hoe, Sohaga and Bar harrow ...	4	12	0	8	0	0	
13 / 6	1 and 3	4	8	Desi plough, broadcasting and Sohaga ...	7	29	0	14	1	13	
	2 and 4	4	8	Broadcasting, horse hoe, Sohaga and Bar harrow	6	37	0	12	23	10	
19 / 9	1 and 3	3	10	Desi plough, broadcasting and Sohaga ...	4	1	0	9	8	0	
	2 and 4	3	10	Broadcasting, horse hoe, Sohaga and Bar harrow ...	3	33	0	8	29	11	
16 / 23	1 and 3	4	8	Desi plough, broadcasting and Sohaga ...	3	37	8	7	6	6	
	2 and 4	4	8	Broadcasting, horse hoe, Sohaga and Bar harrow ...	3	12	8	6	0	15	
7 / 17	1 and 3	4	6	Desi plough, broadcasting and Bar harrow ...	3	30	0	6	39	1	
	2 and 4	4	6	Desi plough, broadcasting, Sohaga and Bar harrow ...	5	16	0	10	1	13	

AVERAGE OUTTURN PER ACRE.

	Mds.	Srs.	Chks.
(1) Desi plough, broadcasting and Sohaga	9	35	7½
(2) Broadcasting, horse hoe, Sohaga and Bar harrow	8	33	11¾
(3) Desi plough, broadcasting and Bar harrow	6	14	14
(4) Desi plough, broadcasting, Sohaga and Bar harrow	10	1	13

Statement No. 24.

OUTTURN OF TORIA GROWN IN SQUARE 26, 1918-19.

No. of square and plot.	No. of sub-plot.	Name of crop.	Previous crop.	Treatment.	Area.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Straw. Maunds.	Straw. Seers.	Straw. Chataks.	Yeild of grain per acre. Maunds.	Seers.	Chataks.	Dates of watering.	Remarks.
26 / 1 A3	b1	Toria.	Wheat.	Ordinary operation of sowing	¼ of an acre.	2	30	0	4	37	0	11	0	0	31st October 1918. 28th November 1918.	Ploughings 3 Harrowings 5 Sohagaings 2 Waterings 2 Date of sowing,—13th September 1918. Date of harvesting,—1st January 1919 to 24th January 1919.
„	b2			Ditto and Bar harrow in addition		2	31	0	4	25	0	11	4	0		
„	a1			Ditto ditto		2	13	0	3	29	0	9	12	0		
„	a2			Ditto		2	10	0	4	29	0	9	0	0		
26 / 2 A3	b1			Ditto and Bar harrow in addition		3	9	0	5	10	0	12	36	0		
„	b2			Ditto		2	31	8	4	25	0	11	6	0		
„	a1			Ditto		2	22	8	4	18	0	10	10	0		
„	a2			Ditto and Bar harrow in addition		2	18	0	4	17	0	9	32	0		
26 / 3 A3	b1			Ditto		3	14	0	5	35	0	13	16	0		
„	b2			Ditto and Bar harrow in addition		2	26	0	4	35	0	10	24	0		
„	a1			Ditto		2	28	8	4	28	0	10	34	0		
„	a2			Ditto		2	27	8	4	32	0	10	30	0		

ORDINARY OPERATION OF SOWING.

	Total area. Acres.	Average yield. Mds.	Srs.	Chks.	Yield per acre. Mds.	Srs.	Chks.
Ordinary operation of sowing	1½	16	15	8	10	37	0
Ordinary operation of sowing and Bar harrow in addition ...	1½	16	15	8	10	30	5

Statement No. 24 (*continued*).

SHOWING THE OUTTURN OF TORIA GROWN IN SQUARE No. 32, BLOCK D, KHARIF 1918.

No. of plot.	No. of sub-plot.	Treatment.	Area.		Actual outturn.			Yield per acre.			Remarks.
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
1	*a*	No harrowing	4	0	6	4	8	12	9	0	
	b	Harrowing	4	0	5	37	8	11	35	0	
2	*a*	Harrowing	4	0	6	22	8	13	5	0	
	b	No harrowing	4	0	7	21	0	15	2	0	
3	*a*	No harrowing	4	0	6	33	0	13	26	0	
	b	Harrowing	4	0	6	14	8	12	29	0	
4	*a*	Harrowing	4	0	6	21	8	13	3	0	
	b	No harrowing	4	0	6	10	0	12	20	0	
5	*a*	No harrowing	4	0	7	14	0	14	28	0	
	b	Harrowing	4	0	6	17	0	12	34	0	
6	*a*	Harrowing	4	0	5	4	8	10	9	0	
	b	No harrowing	4	0	2	11	0	4	22	0	

Ploughings ... ... 3 in plots 1, 2 and 3, and 4 in plots 4, 5 and 6.
Harrowings 3
Horse hoeings 2
Sohagaings ... ... 1 in plots 1, 2 and 3, and two in plots 4, 5 and 6.
Watering ... ... 1 on 21st November 1918.
Date of sowing—29th, 30th September 1918.
Date of harvesting—11th to 18th February 1919.

Average yield per acre.

	Mds.	Srs.	Chks.
Harrowing	12	12	8
No harrowing	12	4	8

Statement No. 25.

EFFECTS OF COMPARATIVE GREEN MANURING ON WHEAT GROWN IN AREA A, SQUARE 2, RABI 1918-19.

No. of square and plot.	No. of sub-plot.	Treatment.	Area.		Actual outturn.						Outturn per acre.						Dates of irrigation.	Remarks.
					Grain.			*Straw.*			*Grain.*			*Straw.*				
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.		
2 A	1	San buried in on 19th September 1918.	2	0	1	10	0	1	35	0	5	0	0	7	20	0	4th January 1919. 27th February 1919. 23rd March 1919.	
	2	Guara ditto ditto	2	0	1	12	8	1	89	0	5	10	0	7	36	0		
	3	San ditto ditto	3	16	4	4	8	6	7	0	8	26	5	13	0	0		
	4	Indigo ditto ditto	3	16	5	8	8	8	35	0	10	31	0	18	27	0		
	5	San ditto ditto	3	17¼	4	12	12	10	34	0	8	38	0	22	19	0		
	6	Mung ditto ditto	3	17¼	5	15	8	6	32	0	11	6	5	14	4	0		
	7	San ditto ditto	3	15½	3	14	8	5	11	0	7	5	10	11	8	0		
	8	Mash ditto ditto	3	15½	3	21	8	5	29	0	7	20	8	12	7	0		
	9	San ditto ditto	3	19¾	4	16	0	9	24	0	8	33	0	19	11	0		
	10	Moth ditto ditto	3	19¾	5	31	0	9	10	0	11	23	6	18	22	0		

Cultivation.

Ploughings 1
Harrowing 1
Sohagaings 3
Waterings 3
Surface harrowings 6
Date of sowing—18th November 1918.
Date of harvesting—27th April to 5th May 1919.

Average yield calculated on yield per acre.

	Mds.	Srs.	Chks.
San	7	28	9
Guara	5	10	0
Indigo	10	30	0
Mung	11	6	5
Mash	7	20	8
Moth	11	23	6

Statement No. 26.

RESIDUAL EFFECT OF COMPARATIVE GREEN MANURING ON WHEAT GROWN IN AREA A, SQUARE 2, RABI 1918-19.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Straw. Maunds.	Straw. Seers.	Straw. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Straw. Maunds.	Straw. Seers.	Straw. Chataks.	Dates of irrigation.	Remarks.
2 A	11	Residue of San buried in on 14th September 1916.	4	8¼	5	16	4	10	7	0	9	32	0	18	18	0	9th February 1919. 16th to 17th March 1919.	
	12	Moth ditto ditto	4	8¼	5	0	0	8	5	0	9	2	11	14	29	0		
	13	Mash ditto ditto	4	13/20	5	14	0	9	31	0	10	24	8	19	16	0		
	14	San ditto ditto	4	1 17/20	5	27	8	9	22	0	10	12	8	18	27	0		
	15	San ditto ditto	4	5⅔	7	22	8	13	10	0	13	21	8	24	33	0		
	16	Mung ditto ditto	4	4⅘	7	2	0	10	6	0	13	12	0	19	6	0		
	17	San ditto ditto	4	¾	6	21	0	9	27	0	12	37	0	19	7	0		
	18	Indigo ditto ditto	4	¾	6	36	8	10	21	0	13	28	0	20	34	0		
	19	San ditto ditto	2	0	2	31	8	5	29	0	11	6	0	22	36	0		
	20	Guara ditto ditto	2	0	2	11	8	4	29	0	9	6	0	18	36	0		

Cultivation.

Ploughing	1
Harrowings	6
Sohagaings	3
Waterings	2
Surface harrowings	3

Date of sowing—30th November 1918 to 1st December 1918.
Date of harvesting—27th April 1919 to 5th May 1919.

Average yield per acre calculated on yield per acre.

	Mds.	Srs.	Chks.
San	11	21	13
Moth	9	2	11
Mash	10	24	8
Mung	13	12	0
Indigo	13	28	0
Guara	9	6	0

Statement No. 27.

RESIDUAL EFFECT OF COMPARATIVE GREEN MANURING WHEAT GROWN IN AREA A, SQUARE 2, RABI 1918-19.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Straw. Maunds.	Straw. Seers.	Straw. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Straw. Maunds.	Straw. Seers.	Straw. Chataks.	Dates of irrigation.	Remarks.
2 A	21	San buried on 7th September 1917	2	0	2	3½	0	4	24	0	8	14	0	18	16	0	8th February 1919, 16th to 17th March 1919.	
	22	Guara ditto ditto	2	0	2	34½	0	6	29	0	11	18	0	26	36	0		
	23	San ditto ditto	4	2	3	21¾	0	6	10	0	6	36⅗	0	12	8	0		
	24	Indigo ditto ditto	4	2	2	8½	0	4	0	0	4	12 7/10	0	7	32	0		
	25	San ditto ditto	4	3	3	4	0	5	14	0	5	39	0	10	13	0		
	26	Mung ditto ditto	4	3	2	19¾	0	5	5	0	4	32⅓	0	9	36	0		
	27	San ditto ditto	4	1	3	2½	0	5	37	0	6	2	0	11	28	0		
	28	Mash ditto ditto	4	1	2	2½	0	5	13	0	4	2½	0	10	21	0		
	29	San ditto ditto	4	5 9/10	3	6	0	6	7	0	5	34⅔	0	11	7	0		
	30	Moth ditto ditto	4	5 9/10	3	8¼	0	5	17	0	5	39	0	10	4	0		

Cultivation.

Ploughing	1
Harrowings	6
Sohagaings	3
Waterings	2
Surface harrowings	3

Date of sowing—30th November 1918 to 1st December 1918.
Date of harvesting—27th April 1919 to 5th May 1919.

Average yield per acre calculated on yield per acre.

	Mds.	Srs.	Chks.
San	6	25	3
Guara	11	18	0
Indigo	4	12	11
Mung	4	32	5
Mash	4	2	8
Moth	5	39	0

Statement No. 28.

RESULTS OF GREEN MANURING ON WHEAT IN AREA C, SQUARE 2, RABI 1918-19, AT THE LYALLPUR AGRICULTURAL STATION.

No. of square and plot.	No. of sub-plot.	Treatment.	Area.		Actual outturn.						Outturn per acre.						Date of irrigation.	Remarks.
					Grain.			*Straw.*			*Grain.*			*Straw.*				
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.		
C 2	1	Guara buried in on 15th September 1918.	6	10 7/30	10	33	0	17	15	0	13	12	0	21	14	0	12th February 1919, 3rd March 1919, 28th March 1919.	
	2	Fallow	6	14 13/20	10	0	0	13	33	0	11	35	5	16	17	0		
	3	Same as 1 ...	7	5 1/7	10	24	0	13	37	0	11	27	6	15	14	0		
	4	Same as 2 ...	7	8	10	1	0	13	28	0	10	33	8	14	33	0		

Cultivation—

	For plots 1 and 3.	For plots 2 and 4
Ploughings	1	3
Harrowings	1	2
Sohagaings	3	3
Waterings	3	3
Surface harrowings	4	4

Date of sowing—10th December 1918.

Date of harvesting—3rd—5th May 1919.

Statement No. 29.

SHOWING RESULTS OF GREEN MANURING WITH WHEAT, PUNJAB TYPE 11, IN TENANTS' AREA, RABI 1918-19.

No. of square, killa and plot.	Treatment.	Area.		Actual outturn.						Outturn per acre of grain.			No. of square, killa and plot.	Treatment.	Area.		Actual outturn.						Outturn of grain per acre.			Remarks.
				Grain.			*Bhusa.*										*Grain.*			*Bhusa.*					
		Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
13—1/19	San buried in on 22nd September 1918.	4	10	8	30	0	18	9	0	15	22	4	13—2/19	Guara buried in on 22nd September 1918.	4	10	5	10	0	11	31	0	9	13	5	
13—1/20	Ditto	4	6	6	23	0	10	4	0	12	9	5	13—2/20	Ditto	4	6	6	15	0	10	8	0	11	34	6	
13—1/21	San buried in on 21st September 1918.	4	3	4	0	0	3	31	0	7	28	7	13—2/21	Guara removed on 21st September 1918.	4	3	3	28	0	4	29	0	7	5	5	
13—1/22	Ditto	4	6	5	22	0	7	34	0	10	13	0	13—2/22	Ditto	4	6	3	31	0	5	24	0	7	0	15	

Ploughings 3
Sohgaings 3
Waterings ... ... 3 on 28th January 1919, 22nd February 1919, 30th March 1919.
Surface harrowings 3
Date of sowing—26th November 1918.
Date of harvesting—24th April 1919.

Average yield per acre.

	Mds.	Srs.	Ch.
San ploughed in ...	13	37	4
Guara ploughed in ...	10	22	11
San ploughed in ...	9	1	10
Guara removed ...	7	3	3

Statement No. 30.

EFFECT OF GREEN MANURING ON WHEAT (TYPE 11) GROWN IN SQUARE 7, RABI 1918-19.

No. of square and plot.	No. of sub-plot.	Treatment.	Area.		Actual outturn.						Outturn per acre.						Irrigation with dates.	Remarks.
					Grain.			*Straw.*			*Grain.*			*Straw.*				
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.		
7/12	1	Fallow	2	2	4	5	0	7	39	0	15	28	9	30	15	5		
7/12	2	Guara sown on 20th May 1918 and ploughed in on 17th July 1918.	2	2	4	13	0	9	0	0	16	19 1/21	0	34	11	7	Three on— 1st January 1919. 13th February 1919. 28th March 1919.	
7/12	3	Fallow	2	2	4	1	0	7	34	0	15	13	5	29	36	3		
7/12	4	Guara sown on 12th August 1918 and ploughed in on 21st September 1918.	2	2	4	0	0	7	27	0	15	9	8	29	9	8		

	Mds.	*Srs.*
Average fallow ...	15	20
„ Guara ...	15	34

Statement No. 31.

RESULTS OF SODIUM NITRATE ON WHEAT GROWN IN SQUARE 7, RABI 1918-19, AT THE AGRICULTURAL STATION, LYALLPUR.

No. of square and killa.	No. of plot.	Quantities of sodium nitrate per acre.	Manured. Outturn per acre. *Grain.* Maunds.	*Grain.* Seers.	*Straw.* Maunds.	*Straw.* Seers.	No. of square and killa.	No. of plot.	Unmanured. Outturn per acre. *Grain.* Maunds.	*Grain.* Seers.	*Straw.* Maunds.	*Straw.* Seers.	Increase (+) or decrease (−) per acre. *Grain.* Maunds.	*Grain.* Seers.	*Straw.* Maunds.	*Straw.* Seers.	Increased + decreased (−) value of grain at Rs. 5-8-0 per maund and that of Bhusa at Re. 1 per maund.	Expenditure on sodium nitrate at Rs. 231 per cwt.	Deficit.	Remarks.
7/8	2	1 1/2 cwt.	11	15	15	29	7/8	1	7	39	9	27	+3	16	−6	2	Grain + Rs. 18 11 3; Bhusa − 6 0 9; + 12 10 6	Rs. 34 8 0	Rs. 21 13 6	
7/9	1	1 cwt.	9	35	20	13	7/9	2	13	30	13	16	−3	35	+6	37	Grain − Rs. 21 5 0; Bhusa + 6 15 0; − 14 6 0	23 0 0	37 6 0	

Cultivation.

Ploughings	3
Harrowings	2
Sohagaings	3
Waterings	3 on 16th February 1919, 8th March 1919 and 28th March 1919.
Surface harrowings	3

Date of sowing—10th December 1918.

Date of harvesting—25th September 1918.

Statement No. 32.

RESULTS OF MANURIAL EXPERIMENTS WITH SUGARCANE IN TENANTS' AREA, YEAR 1918-19.

No. of square and plot.	No. of sub-plot.	Variety of cane.	Treatment.	Area.		Weight of green tops.			Weight of cane.			Weight of juice.			Weight of gur.			Yield of gur per acre.			Percentage of green tops to cane.	Percentage of juice to cane.	Percentage of gur to juice.	Percentage of gur to cane.	Remarks.
				Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.					
13 / 9	1	Local cane ..	Unmanured	2	9	44	13	0	91	35	0	50	3	0	8	26	0	28	9 13/16	0	48·24	54·50	17·27	9·41	Waterings, 12 on 12th May 1918, 15th June 1918, 4th July 1918, 11th July 1918, 25th July 1918, 8th August 1918, 20th August 1918, 28th August 1918, 7th September 1918, 17th September 1918, 30th September 1918, 11th October 1918.
	2	Do. ...	Toria cake at 10 maunds per acre.	2	9	56	18	0	106	28	0	57	7	0	9	26½	0	31	21 14/16	0	52·90	53·58	16·87	9·04	
	3	Do. ...	Unmanured	2	9	52	26	0	100	17	0	52	22	0	9	0	0	29	15½	0	52·42	52·32	17·12	8·96	Hoeings and harrowings, 4 on 16th May 1918, 16th May 1918, 18th May 1918, 23rd August 1918.
	4	Do. ...	Toria cake at 10 maunds per acre.	2	3	37	0	0	63	30	0	37	19	0	6	39	0	25	38⅛	0	58·03	58·78	18·61	10·94	Date of sowing—6th April 1918. Crushing began on 21st December 1918. Crushing finished on 10th January 1919.

AVERAGE OUTTURN PER ACRE.

	Maunds.	Seers.	Chataks.
(a) Unmanured plot ...	28	32	10⅛
(b) Toria cake ...	28	30	0

7 / 14	1	Local cane ...	Farm yard manured at 15 tons per acre.	2	1	40	19	0	44	9	0	22	37	0	4	12	0	16	31 3/16	0	91·52	51·83	18·75	9·72	Waterings, 11 on 17th May 1918, 16th June 1918, 12th July 1918, 18th July 1918, 28th July 1918, 12th August 1918, 23rd August 1918, 5th September 1918, 12th September 1918, 20th September 1918, 4th October 1918.
	2	Do. ...	Toria cake at 15 maunds per acre.	2	1	46	30	0	59	12	0	34	16	0	6	37	0	27	1	0	78·83	58·01	20·13	11·67	Hoeings and harrowings, 5 on 21st May 1918, 21st May 1918, 18th June 1918, 2nd August 1918, 23rd August 1918.
	3	Do. ...	Farm yard manured at 15 tons per acre.	2	1	44	9	0	48	26	0	32	20	0	6	24	0	25	30 3/16	0	90·90	66·80	20·03	13·56	Date of sowing—21st April 1918.
	4	Do. ...	Toria cake at 15 maunds per acre.	1	13	40	17	0	46	11	0	27	20	0	5	18	0	26	17	0	89·33	59·69	19·72	11·77	Crushing began on 15th February 1919. Crushing finished on 28th February 1919.

AVERAGE OUTTURN PER ACRE.

	Maunds.	Seers.	Chataks.
(a) Farm yard manured plot ...	21	10	11
(b) Toria cake	26	29	0

STATEMENT No. 33.

Statement

RESULTS OF DIFFERENT NUMBER OF WATERINGS WITH

TWO WATERINGS.

No. of square and block.	No. of plot and sub-plot.	Variety.	Area.		Actual outturn.						Outturn per acre.						Remarks.
					Grain.			*Bhusa.*			*Grain.*			*Bhusa.*			
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
32 B	1 *b*	Punjab 11	1	$10\frac{19}{21}$	5	28	8	11	16	0	29	39	10	59	34	...	Lodging 9 per cent., damaged by white ants 13 per cent., slightly smutted.
	1 *b*	Pusa 12	1	$11\frac{3}{7}$	5	11	12	9	1	0	26	38	0	45	37	13	Lodging 17 per cent., damaged by white ants 15 per cent., slightly smutted.
	2 *b*	Punjab 11	1	$11\frac{3}{7}$	4	15	0	12	36	0	22	10	$14\frac{1}{2}$	65	26	14	Damaged by white ants 15 per cent., slightly smutted.
	2 *b*	Pusa 12	1	$11\frac{3}{7}$	4	26	4	8	12	0	28	28	3	42	10	3	Ditto.
	3 *b*	Punjab 11	1	$10\frac{19}{21}$	4	35	4	12	5	0	25	9	$4\frac{1}{2}$	62	27	1	Ditto.
	3 *b*	Pusa 12	1	$11\frac{3}{7}$	4	34	0	9	4	0	24	27	10	46	13	1	Ditto.
	4 *b*	Punjab 11	1	$10\frac{19}{21}$	4	11	4	8	2	0	22	19	1	42	10	8	Damaged by white ants 14 per cent., slightly smutted.
	4 *b*	Pusa 12	1	$11\frac{3}{7}$	4	9	8	8	6	0	21	22	$14\frac{1}{2}$	41	19	10	Ditto.
	5 *b*	Punjab 11	1	$11\frac{3}{7}$	4	14	12	9	28	0	22	9	10	49	15	4	Ditto.
	5 *b*	Pusa 12	1	$11\frac{3}{7}$	3	25	12	8	0	0	18	22	0	40	29	1	Ditto.
	6 *b*	Punjab 11	1	$11\frac{3}{7}$	5	39	0	12	25	0	30	11	$11\frac{1}{2}$	64	10	14	Ditto.
	6 *b*	Pusa 12	1	$11\frac{3}{7}$	5	37	8	12	22	0	30	9	$1\frac{1}{2}$	63	35	12	Lodging 43 per cent., damaged by white ants 14 per cent., slightly smutted

	Mds.	Srs.	Chks.	
Average Punjab 11 =	25	17	$8\frac{1}{2}$	From calculated outturn per acre.
„ Pusa 12 =	24	11	5	

Irrigation with dates—(1) 28th January 1919 in all plots.

(2) 3rd March in $\frac{32}{B_2}$ *b*

12th March in $\frac{32}{B_1}$ *b*, $\frac{32}{B_3}$

16th March in $\frac{32}{B_4}$, $\frac{32}{B_5}$, $\frac{32}{B_6}$

Ploughings	...	...	...	3
Harrowings	...	...	...	2
Cultivating with horse hoe	...		...	4
Sohagaings	...	...	...	3
Surface harrowings		...	...	2 in all

No. 33.

WHEAT TYPES, PUNJAB 11, AND PUSA 12, RABI 1918-19.

THREE WATERINGS.

No. of square or block.	No. of plot and sub-plot.	Variety.	Area, Kanals.	Area, Marlas.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Remarks.
32 B	1 *a*	Punjab 11	1	$10\frac{10}{11}$	5	3	0	9	39	0	26	25	12	52	14	12	Lodging 6 per cent., damaged by white ants 10 per cent., slightly smutted
	1 *a*	Pusa 12	1	$11\frac{3}{7}$	4	0	0	6	7	0	20	14	9	31	17	7	Ditto ditto.
	2 *a*	Punjab 11	1	$11\frac{3}{7}$	5	37	4	11	22	0	30	7	13	58	32	0	Lodging 22 per cent., slightly smuted, damaged by white ants 8 per cent.
	2 *a*	Pusa 12	1	$11\frac{3}{7}$	5	28	12	10	9	0	29	4	9	52	2	3	Ditto ditto.
	3 *a*	Punjab 11	1	$10\frac{10}{11}$	4	38	4	10	21	0	25	24	13	54	16	4	Damaged by white ants 8 per cent., lodging 6 per cent.
	3 *a*	Pusa 12	1	$11\frac{3}{7}$	4	27	12	7	35	0	23	35	13	40	3	10	Damaged by white ants 8 per cent., lodging 38 per cent.
	4 *a*	Punjab 11	1	$10\frac{10}{11}$	4	22	4	9	31	0	23	36	13	51	12	12	Lodging 4 per cent., damaged by white ants 8 per cent, slightly smutted
	4 *a*	Pusa 12	1	$11\frac{3}{7}$	4	15	0	8	10	0	22	10	$14\frac{1}{2}$	42	0	0	Ditto ditto.
	5 *a*	Punjab 11	1	$11\frac{3}{7}$	5	4	4	11	1	0	25	39	13	56	5	1	Slightly smutted, damaged by white ants 8 per cent.
	5 *a*	Pusa 12	1	$11\frac{3}{7}$	4	33	12	9	33	0	24	26	6	50	0	12	Ditto ditto.
	6 *a*	Punjab 11	1	10	6	2	4	13	28	0	32	12	0	73	2	11	Lodging 30 per cent., slighty smutted, damaged by white ants 6 per cent.
	6 *a*	Pusa 12	1	$11\frac{3}{7}$	5	35	0	11	0	0	29	36	6	56	0	0	Lodging 80 per cent., slightly smutted, damaged by white ants 6 per cent.

		Mds.	Srs.	Chks.
Average outturn Punjab	11 =	27	17	$13\frac{1}{3}$
„ „ Pusa	12 =	25	1	15

Irrigation with dates—(1) 4th January 1919.

(2) 28th January 1919.

(3) 3rd March in $\frac{32}{B_2}$ *a*.

Date of sowing—16th November 1918 ... 12th March in $\frac{32}{B_1}$ *a*, $\frac{32}{B_3}$ *a*.

Dates of harvesting—21st to 26th April 1919 ... 16th March in $\frac{32}{B_4}$, $\frac{32}{B_5}$, $\frac{32}{B_6}$

plots of two irrigations, 4 in all plots of three waterings.

Statement No. 34 (*a*).

COMPARATIVE TESTS OF WHEAT TYPES 8-A, PUNJAB 11 AND 8-B, RABI 1918-19.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area in acres.	Actual outturn. *Grain.* Maunds.	Seers.	Chataks.	*Bhusa.* Maunds.	Seers.	Chataks.	Outturn per acre. *Grain.* Maunds.	Seers.	Chataks.	*Bhusa.* Maunds.	Seers.	Chataks.	Previous crops.	Dates of watering.	Remarks.
26 A 4	1 *a*	8-A ...	½	9	7	8	15	13	8	18	15	0	30	27	0	Wheat	24th December 1918. 18th February 1919. 16th March 1919.	Germination good. Tillering good. Had a serious attack of white ants. Crop became very thin. It was 20 per cent. thinner than type 11 and 30 per cent. thinner than 8-B.
	1 *b*	8-A ...	½	9	10	8	15	38	8	18	21	0	31	37	0	Do.		
	2 *a*	Pb. type 11 ...	½	8	8	0	13	1	0	16	16	0	26	2	0	Do.		Germination good. Tillering good. Had an attack of white ants but not to the same extent as in 8-A. This crop was thinner than 8-B by 10 per cent.
	2 *b*	Pb. type 11 ...	½	10	25	0	17	29	0	21	10	0	35	18	0	Do.		
	3 *a*	8-B ...	½	5	31	0	12	33	0	11	22	0	25	26	0	Do.		Germination good. Tillering good. Had only a slight attack of white ants. Crop was not thin but quite uniform.
	3 *b*	8-B ...	½	8	24	0	19	31	0	17	8	0	39	22	0	Do.		

Ploughings 2
Harrowings 7
Sohagaings 3
Surface harrowing and weeding 4
Date of sowing—31st October 1918.
Date of harvesting—21st April 1919.

Average yield per acre.

Type	Mds.	Srs.
8-A	18	18
Pb. 11	18	33
8.B	14	15

N. B.—Seed rate in 8-A and type 11 was 24 seers per acre.
Seed rate in 8-B was 27 seers per acre.

Statement No. 34 (*b*).

COMPARATIVE TESTS OF WHEAT TYPES 8-A, PB. 11 AND 8-B., RABI 1918-19.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area in acres.	Actual outturn. *Grain.* Maunds.	Seers.	Chataks	*Bhusa.* Maunds.	Seers.	Chataks.	Outturn per acre. *Grain.* Maunds.	Seers.	Chataks.	*Bhusa.* Maunds.	Seers.	Chataks.	Previous crop.	Dates of watering.	Remarks.
26 A1	1 *a*	8-A ...	½	13	35	0	25	31	0	27	30	0	51	22	0	Cotton	23rd December 1918. 18th February 1919. 16th March 1919.	Germination good. Tillering good. Slightly attacked by white ants in early stages. About a week later in earing than type 11.
	1 *b*	8-A ...	½	13	16	8	25	29	8	26	33	0	51	19	0	Do.		Germination good. Tillering good. Had a slight attack of white ants. Lodging 8 per cent.
	2 *a*	Pb. 11 ...	½	13	9	0	22	24	0	26	18	0	45	8	0	Do.		Germination good. Tillering good. Had a slight attack of white ants.
	2 *b*	Pb. 11 ...	½	11	38	8	24	3	8	23	37	0	48	7	0	Do.		Ditto ditto.
	3 *a*	8-B ...	½	10	17	0	23	10	0	20	34	0	46	20	0	Do.		Ditto ditto.
	3 *b*	8-B ...	½	10	26	0	21	19	0	21	12	0	42	38	0	Do.		Ditto ditto.

Ploughings 3
Harrowings 7
Sohagaings 5
Surface harrowings and weedings ... 4
Date of sowing—30th October 1918.
Date of harvesting—22nd and 23rd April 1919.

Average yield.

Total area	Type	Mds.	Srs.
One acre ...	8-A	27	11½
Do. ...	Pb. 11	25	7½
Do. ...	8-B	21	3

N. B.—Seed rate used in 8-A and Pb. 11 was 24 seers per acre while in 8-B it was 27 seers per acre

Statement No. 35.

COMPARATIVE TESTS OF WHEATS TYPES 8-A, PUNJAB 11 AND 8-B IN NEW AREA, RABI 1918-19.

No. of square and block.	No. of plot and sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
43 A.	1 *i*	8-A ...	1	5	3	9	0	20	25	9½	Lodging 9 per cent.
	1 *ii*	Punjab 11 ...	1	5	3	37	3	25	6	0	
	1 *iii*	8-B ...	1	5	2	30	3	17	25	3⅕	Lodging 10 per cent.
	1 *iv*	8-A ...	1	5	2	34	0	18	9	9½	Lodging 6 per cent.
	1 *v*	Punjab 11 ...	1	5	3	33	4	24	20	13	
	1 *vi*	8-B ...	1	5	3	16	8	21	33	9½	
	2 *i*	8-A ...	1	5	4	3	12	26	8	0	Lodging 18 per cent.
	2 *ii*	Punjab 11 ...	1	5	4	14	4	27	35	3	Lodging 17 per cent.
	2 *iii*	8-B ...	1	5	2	37	4	18	30	6½	Lodging 17 per cent.
	2 *iv*	8-A ...	1	5	4	7	8	26	32	0	Lodging 32 per cent.
	2 *v*	Punjab 11 ...	1	6¼	4	4	8	25	2	11	Lodging 9 per cent.
	2 *vi*	8-B ...	1	5	3	10	4	20	33	9½	Lodging 3 per cent.
	3 *i*	8-A ...	1	5	4	7	15	26	34	13	Lodging 14 per cent.
	3 *ii*	Punjab 11 ...	1	5	4	18	4	28	20	13	Lodging 19 per cent.
	3 *iii*	8-B ...	1	5	2	27	0	17	4	13	Lodging 21 per cent.
	3 *iv*	8-A ...	1	5	4	5	4	26	17	9½	Lodging 32 per cent.
	3 *v*	Punjab 11 ...	1	5	3	38	0	25	11	3	Lodging 6 per cent.
	3 *vi*	8-B ...	1	5	3	21	4	22	24	0	Lodging 7 per cent.
	4 *i*	8-A ...	1	5	3	18	4	22	4	13	
	4 *ii*	Punjab 11 ...	1	5	3	38	8	25	14	6½	
	4 *iii*	8-B ...	1	5	3	3	12	19	32	0	
	4 *iv*	8-A ...	1	5	2	38	4	18	36	13	Lodging 7 per cent.
	4 *v*	Punjab 11 ...	1	1¼	3	8	12	24	9	6½	
	4 *vi*	8-B ...	1	0	2	37	0	23	16	0	
	5 *i*	8-A ...	1	5	4	11	0	27	14	6½	Lodging 37½ per cent.
	5 *ii*	Punjab 11 ...	1	0	3	8	0	25	24	0	
	5 *iii*	8-B ...	1	0	2	17	0	19	16	0	
	5 *iv*	8-A ...	1	1¼	3	5	4	23	23	1	
	5 *v*	Punjab 11 ...	1	2½	3	24	0	25	24	0	
	5 *vi*	8-B ...	1	0	2	14	0	18	32	0	
	6 *i*	8-A ...	1	5	4	12	4	27	22	6½	Lodging 8 per cent.
	6 *ii*	Punjab 11 ...	1	1¼	3	20	4	26	16	0	Lodging 10 per cent.
	6 *iii*	8-B ...	1	0	2	25	8	21	4	0	Lodging 8 per cent.
	6 *iv*	8-A ...	1	2½	3	14	8	23	36	7	
	6 *v*	Punjab 11 ...	1	0	3	18	5	27	26	8	Lodging 3 per cent.
	6 *vi*	8-B ...	1	0	2	15	0	19	0	0	

Statement No. 35 (*continued*).

COMPARATIVE TESTS OF WHEATS TYPES 8-A, PUNJAB 11 AND 8 B IN NEW AREA, RABI 1918-19.

No. of square and Block.	No. of plot and sub-plot.	Variety.	Area. Kanals.	Area. Marals.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
43 A.	7 *i*	8-A ...	1	5	4	4	5	26	11	10	
	7 *ii*	Punjab 11 ...	1	1¼	3	19	13	26	12	11	Lodging 4 per cent.
	7 *iii*	8-B ...	1	0	2	4	0	16	32	0	
	7 *iv*	8-A ...	1	2½	3	1	11	21	25	5	
	7 *v*	Punjab 11 ...	0	18¾	2	32	2	23	36	13	
	7 *vi*	8-B ...	1	0	2	23	0	20	24	0	
	8 *i*	8-A ...	1	5	4	0	8	25	27	3	
	8 *ii*	Punjab 11 ...	1	0	3	18	0	27	24	0	
	8 *iii*	8-B ...	1	1¼	3	3	0	23	6	2	
	8 *iv*	8-A ...	1	2½	3	22	8	25	13	5	Lodging 14 per cent.
	8 *v*	Punjab 11 ...	1	1¼	3	20	8	26	17	14	Lodging 14 per cent.
	8 *vi*	8-B ...	1	0	3	3	3	24	28	0	Lodging 31 per cent.
	9 *i*	8-A ...	1	5	3	39	1	25	18	0	Lodging 40 per cent.
	9 *ii*	Punjab 11 ...	1	1¼	3	4	2	23	14	9½	Lodging 2 per cent.
	9 *iii*	8 B ...	1	3½	3	8	0	21	22	5	Lodging 11 per cent.
	9 *iv*	8-A ...	1	5	3	34	1	24	26	0	Lodging 26 per cent.
	9 *v*	Punjab 11 ...	1	2½	3	38	0	28	3	9	Lodging 30 per cent.
	9 *vi*	8-B ...	1	0	2	26	0	21	8	0	

Irrigations with dates—(1) 3rd to 5th January 1919.

(2) 15th February 1919.

(3) 24th to 26th March 1919.

Ploughings 2

Harrowings 4

Cultivating with horse hoe 1

Sohagaings 2

Surface harrowings ... ... 4 but 6 in $\frac{43}{A\ 9}$.

Date of sowing—11th to 14th November 1918.

Date of harvesting—23rd April to 4th May 1919.

Average out turn per acre calculated from actual figures.

	Mds.	Srs.	Chts.
8-A ...	24	13	5
Punjab 11 ...	25	38	1
8-B ...	20	16	14

Average outturn per acre calculated from cutturn per acre

	Mds.	Srs.	Chks.
8-A ...	24	14	14¼
Punjab 11 ...	25	37	13⅓
8-B ...	20	18	7

Statement No. 36.

COMPARATIVE VARIETAL TESTS OF WHEATS (TYPE 11 AND 8-A) GROWN IN TENANTS' AREA DURING RABI 1918-19.

No. of square and killa.	No. of plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Irrigation with dates.	Remarks.
	1	Punjab 11 ...	1	18	6	38	0	29	10	8	Three on— 1st January 1919. 10th February 1919. 30th March 1919.	Germination good, tillering good, lodging 12½ per cent.
6	2	8-A ...	1	18	7	8	0	30	12	10		Germination good, tillering good, lodging 10 per cent.
16	3	Punjab 11 ...	1	18	7	0	0	29	18	0		Germination good, tillering good, lodging 40 per cent.
	4	8-A ...	1	18	5	23	0	23	18	0		Germination thin, tillering well, lodging 75 per cent.
	1	Punjab 11 ...	1	19	3	26	0	14	39	0	Three on— 26th January 1919. 20th February 1919. 30th March 1919.	
10	2	8-A ...	1	19	2	37	0	12	0	0		
3	3	Punjab 11 ...	1	19	2	23	0	19	22	9		
	4	8-A ...	1	19	3	26	0	14	39	0		
	1	Punjab 11 ...	2	5	6	14	0	22	23	2	Three on— 1st January 1919. 22nd February 1919. 17th March 1919.	Germination and tillering good, lodging 5 per cent.
13	2	8-A ...	2	5	6	30	0	24	0	0		Germination and tillering good, lodging 50 per cent.
7	3	Punjab 11 ...	2	5	6	39	0	24	32	0		Germination and tillering good, lodging 10 per cent.
	4	8-A ...	2	5	6	22	0	23	11	8		Germination and tillering good, lodging 50 per cent.
	1	Punjab 11 ...	2	0	6	28	0	26	32	0	Three on— 2nd January 1919. 22nd February 1919. 17th March 1919.	Germination and tillering good, lodging 100 per cent.
13	2	8-A ...	2	0	6	8	0	24	32	0		Germination and tillering good, lodging 100 per cent.
14	3	Punjab 11 ...	2	0	6	4	0	24	16	0		Germination and tillering good, lodging 80 per cent.
	4	8-A ...	2	0	4	39	0	19	36	0		Germination and tillering good lodging 100 per cent. Suffered through high land.
	1	Punjab 11 ...	2	4	4	5	0	15	0	0	Three on— 29th January 1919. 23rd February 1919. 31st March 1919.	
16	2	8-A ...	2	4	4	3	0	14	32	12		
10	3	Punjab 11 ...	2	4	2	24	0	9	18	3		
	4	8-A ...	2	4	2	28	0	9	32	12		
	1	Punjab 11 ...	2	0	2	23	0	10	12	0	Three on— 29th January 1919. 23rd February 1919. 31st March 1919.	
16	2	8-A ...	2	0	3	23	0	14	12	0		
11	3	Punjab 11 ...	2	0	4	9	0	16	36	0		
	4	8-A ...	2	0	3	34	0	15	16	0		
	1	Punjab 11 ...	1	18	5	20	0	23	6	5	Three on— 30th January 1919. 28th February 1919. 20th March 1919.	Germination and tillering fair lodging 5 per cent.
19	2	8-A ...	1	18	5	13	0	22	16	13		Germination and tillering fair, lodging 50 per cent.
11	3	Punjab 11 ...	1	18	5	30	0	24	8	7		Germination and tillering fair, no lodging.
	4	8-A ...	1	18	5	11	0	22	8	7		Germination and tillering fair, no lodging.
	1	Punjab 11 ...	2	9	3	23	0	11	27	0	Three on— 23rd January 1919. 10th March 1919. 28th March 1919.	No lodging.
19	2	8-A ...	2	9	2	26	0	8	26	2		No lodging.
23	3	Punjab 11 ...	2	9	6	14	0	20	29	6		Whole lodged.
	4	8-A ...	2	9	6	15	0	20	32	10		Whole lodged.
	1	Punjab 11 ...	1	19	6	39	0	28	24	2	Three on— 4th January 1919. 24th February 1919. 27th March 1919.	Germination and tillering good, lodging 95 per cent.
20	2	8-A ...	1	19	6	11	0	25	29	12		Germination and tillering good, lodging 100 per cent.
3	3	Punjab 11 ...	1	19	6	17	0	26	14	6		Germination and tillering good, lodging 90 per cent.
	4	8-A ...	1	19	5	22	0	22	30	12		No lodging but land poor & sandy.

Average outturn.

	Total area. Kanals.	Total area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.
Punjab 11	37	4	94	16	20	12
8-A	37	4	89	19	19	$9\frac{19}{16}$

AVERAGE PER ACRE CALCULATED ON YIELD PER ACRE.

	Mds.	Seers.	Chks.
Punjab 11	20	20	8
8-A	19	17	1

Statement No. 37.

COMPARATIVE VARIETAL TESTS OF WHEATS (TYPE 11 AND 8-B) GROWN IN TENANTS AREA, DURING RABI 1918-19.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Irrigation with dates.	Remarks.
5/12	1	Punjab 11 ...	2	4	7	18	0	27	3	10	Three on— 1st January 1919. 10th February 1919. 18th March 1919.	No lodging.
	2	8-B ...	2	4	6	2	0	22	0	0		Lodging 5 per cent., shedding of grains much.
	3	Punjab 11 ...	2	4	8	9	0	29	36	6		Lodging cent. per cent.
	4	8-B ...	2	4	6	30	0	24	21	13		Lodging cent. per cent., shedding of grain is much.
5/19	1	Punjab 11 ...	2	4	8	17	0	30	25	7	Three on— 7th January 1919. 7th March 1919. 30th March 1919.	Lodging 90 per cent.
	2	8-B ...	2	4	8	24	0	31	11	0		Lodging 90 per cent., shedding of grain is tremendous
	3	Punjab 11 ...	2	4	9	0	0	32	29	1		Lodging 80 per cent.
	4	8-B ...	2	4	7	38	0	28	36	6		Lodging 95 per cent., shedding of grain is tremendous.
7/22	1	Punjab 11 ...	2	1	5	30	0	22	17	9	Three on— 26th January 1919. 26th February 1919. 22nd March 1919.	
	2	8-B ...	2	1	3	15	0	13	6	13		
	3	Punjab 11 ...	2	1	4	5	0	16	3	14		
	4	8-B ...	2	1	3	37	0	15	12	11		
7/23	1	Punjab 11 ...	2	2	3	38	0	15	1	14	Three on— 26th January 1919. 26th February 1919. 22nd March 1919.	
	2	8-B ...	2	2	2	35	0	10	38	2		
	3	Punjab 11 ...	2	2	2	16	0	9	5	11		
	4	8-B ...	2	2	2	27	0	10	7	9		
11/9	1	Punjab 11, ...	2	0	4	28	0	18	32	0	Three on— 19th January 1919. 21st February 1919. 18th March 1919.	Lodging 10 per cent.
	2	8-B ...	2	0	4	32	0	19	8	0		„ 15 per cent.
	3	Punjab 11 ...	2	0	6	8	0	24	32	0		„ 20 per cent.
	4	8-B ...	2	0	5	9	0	20	36	0		„ 30 per cent.
16/16	1	Punjab 11 ...	2	1	5	5	0	20	0	0	Three on— 20th January 1919. 23rd February 1919. 17th March 1919.	Lodging 1[illegible] per cent.
	2	8-B ...	2	1	5	34	0	22	33	3		„ 50 per cent.
	3	Punjab 11 ...	2	1	5	25	0	21	38	1		„ 75 per cent.
	4	8-B ...	2	1	5	37	0	23	4	14		„ 95 per cent.
17/24	1	Punjab 11 ...	1	19	6	22	0	26	34	14	Three on— 4th January 1919. 24th February 1919. 27th March 1919.	Lodging in 2 marlas only.
	2	8-B ...	1	19	5	7	0	21	9	4		„ 4 marlas only.
	3	Punjab 11 ...	1	19	5	39	0	24	20	8		No lodging.
	4	8-B ...	1	19	5	30	0	23	23	9		Lodging in 2 marlas only.
		Average outturn.										
		Punjab 11 ...	29	2	83	20	0	22	38	3		
		8-B ...	29	2	74	37	0	20	23	14		

Average outturn per acre calculated on yield per acre.

	Maunds.	Seers.	Chataks.
Punjab 11	22	34	5
8-B	20	20	10

Statement No. 38.

COMPARATIVE VARIETAL TESTS OF WHEATS (8-A AND 8-B) GROWN IN TENANTS' AREA DURING RABI 1918-19.

No. of square and kills.	No. of plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Irrigation with date.	Remarks.
12/2	1 & 3	8-A	3	12	9	21	0	21	6	10	Three on— 7th January 1919. 10th February 1919. 18th March 1919.	
	2 & 4	8-B	3	12	8	16	0	18	26	11		
12/3	1 & 3	8-A	3	15	12	4	0	25	32	8	Three on— 7th January 1919. 10th February 1919. 18th March 1919.	
	2 & 4	8-B	3	15	10	3	0	21	19	12		
12/4	1 & 3	8-A	3	18	7	32	0	16	0	0	Three on— 7th January 1919. 10th February 1919. 18th March 1919.	
	2 & 4	8-B	3	18	6	10	0	12	32	13		
13/17	1 & 3	8-A	4	8	14	21	0	26	16	6	Three on— 2nd January 1919. 22nd February 1919.	Lodging cent. per cent.
	2 & 4	8-B	4	8	14	17	0	26	9	1	17th March 1919.	Lodging cent per cent. Shedding of grain is much.
16/8	1 & 3	8-A	4	10	8	16	0	14	37	5	Three on— 29th January 1919. 23rd February 1919.	
	2 & 4	8-B	4	10	6	24	0	11	29	5	31st March 1919.	
16/9	1 & 3	8-A	4	4	5	33	0	11	3	13	Three on— 29th January 1919. 23rd February 1919.	
	2 & 4	8-B	4	4	6	29	0	12	32	6	31st March 1919.	
16/18	1 & 3	8-A	4	10	12	15	0	22	0	0	Three on— 20th January 1919. 23rd February 1919.	Lodging 40 to 50 per cent.
	2 & 4	3-B	4	10	12	1	0	21	15	2	17th March 1919.	Lodging 40 to 50 per cen Shedding of grain is much
17/12	1 & 3	8-A	4	0	14	28	0	29	16	0	Three on— 4th January 1919. 24th February 1919.	Lodging 95 per cent.
	2 & 4	3-B	4	0	13	23	0	27	6	0	27th March 1919.	Lodging 50 to 75 per cent. Shedding of grain is much.
17-/18	1 & 3	8-A	4	4	14	10	0	27	5	11	Three on— 17th January 1919. 24th February 1919.	Lodging 75 per cent.
	2 & 4	8-B	4	4	12	32	0	24	15	4	1st April 1919.	Lodging 20 per cent. Shed ding of grain is much.

	Average outturn									Average per acre calculated on yield per acre			
											Mds.	Srs.	Chks.
	8-A	37	1	99	20	0	21	19	6	...	21	22	0
	8-B	37	1	90	35	0	19	24	14	...	19	25	2

Statement No. 39.

COMPARATIVE VARIETAL TESTS OF WHEATS (PUNJAB 17 AND 8-B) GROWN IN TENANTS' AREA DURING RABI 1918-19.

No. of square and kills.	No. of plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Irrigation with dates.	Remarks.
16/21	1 & 3	Punjab 17 ...	4	4	10	0	0	19	1	14	Three on— 20th January 1919. 23rd February 1919.	Lodging 95 per cent.
	2 & 4	8-B	4	4	10	15	0	19	30	8	17th March 1919.	Lodging 95 per cent.
16/22	1 & 3	Punjab 17 ...	4	4	11	30	0	22	15	4	Three on— 20th January 1919. 23rd February 1919.	Lodging 50 per cent.
	2 & 4	8-B	4	4	10	26	0	20	11	7	17th March 1919.	Lodging 50 per cent.
		Average outturn.										
		Punjab 17 ...	8	8	21	30	6	20	28	9		
		8-B	8	8	21	1	0	20	1	0		
			Average per acre calculated on yield per acre.					Mds.	Srs.	Chks.		
		Punjab 17 ...	...		...		...	20	28	9		
		8-B	...		...		...	20	0	15		

Statement No. 40.

COMPARATIVE VARIETAL TESTS OF ECONOMIC BOTANIST'S BARLEYS SOWN IN SQUARE 26, RABI 1918-19.

Square and plot.	Sub-plots.	Name of variety.	Area in acres.	Actual outturn. *Grain.* Maunds.	Seers.	Chataks.	*Bhusa.* Maunds.	Seers.	Chataks.	Outturn per acre. *Grain.* Maunds.	Seers.	Chataks.	*Bhusa.* Maunds.	Seers.	Chataks.	Dates of watering.	Remarks.
26/B	1	Lyallpur Barley...	¼	4	36	0	7	8	0	19	24	0	28	32	0	23rd December 1918. 25th January 1919. 28th February 1919.	Ploughing ... 1
	2	Economic Botanist's Barley No. 5.	¼	3	25	0	3	23	0	14	20	0	14	12	0		Harrowings ... 7
																	Sohagaings ... 3
	3	Lyallpur Barley...	¼	4	8	0	5	32	0	16	32	0	23	8	0		Surface harrowings ... 3
	4	Economic Botanist's Barley No. 2.	¼	4	14	0	5	30	0	17	16	0	23	0	0		Date of sowing - 2nd November 1918.
	5	Lyallpur Barley ..	¼	3	5	0	4	7	0	12	20	0	16	28	0		Date of harvesting—16th April 1919.
	6	Economic Botanist's Barley No. 1.	¼	3	16	0	4	16	0	13	24	0	17	24	0		*N. B.*—All plots suffered heavily from white ants' attack and somewhat from the attack of smut.
	7	Lyallpur Barley ...	¼	3	31	0	5	9	0	15	4	0	20	36	0		

Statement No. 41.

RESULTS OF GRAMS HANDED OVER BY THE ECONOMIC BOTANIST TO GOVERNMENT, PUNJAB, IN 1918 AND GROWN ON TENANTS AREA DURING RABI 1919.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area in marlas.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds	Seers.	Chataks.	Remarks.
16/13	1	Local Mixture	39	3	30	0	15	15	6	This was irrigated only on 31st March 1919 with a view to plough up the land.
16/13	2	Economic Botanist's No. 17 ...	39	4	12	0	17	15	6	After harvest. otherwise practically no irrigation to this crop.
16/13	3	Local Mixture	39	3	37	0	16	4	1	Ditto ditto.
16/13	4	Economic Botanist's No. 20 ...	39	3	7	0	13	1	0	Dit'o ditto. Gram wilt was present here.
17/23	1	Local Mixture	41	5	0	0	19	20	7	This received one irrigation on 18th March 1919.
17/23	2	Economic Botanist's No. 7 ...	41	6	12	0	24	23	7	Ditto ditto.
17/23	3	Local Mixture	41	5	0	0	19	20	7	Ditto ditto.
17/23	4	Economic Botanist's No. 15 ...	41	3	26	0	14	9	12	Dittto ditto. This plot suffered in ¼ area owing to the land being rather high and saline in nature. Also suffered from wilt which was bad here.

		Average yield per acre. *Total area in marlas.*	*Total yield.* Mds.	Srs.	Chks.	Yield per acre. Mds.	Srs.	Chks.
1	Local Mixture	160	17	27	0	17	27	0
2	Economic Botanist's No. 17 ...	39	4	12	0	17	15	6
3	Economic Botanist's No. 20 ...	39	3	7	0	13	1	0
4	Economic Botanist's No. 7 ...	41	6	12	0	24	23	7
5	Economic Botanist's No. 15 ...	41	3	26	0	14	9	12

Statement No. 42.

SHOWING THE COMPARATIVE RESULTS OF 4-F AND 280-F (AMERICAN COTTON) VARIETIES GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION, KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Irrigation with dates.	Remarks.
13/7	1	4-F	2	4	Calcareous loam.	3	34	5	14	1	2	Five on— 13th May 1918. 24th May 1918. 18th June 1918. 21st July 1918. 15th August 1918.	Seven on— 11th May 1918. 16th June 1918. 19th July 1918. 12th August 1918. 2nd September 1918. 20th September 1918. 4th October 1918.	Early sown. Germination poor.
	2	280-F	2	4		2	30	8	10	1	13			
	3	4-F	2	4		3	28	11	13	20	11			
	4	280-F	2	4		2	16	15	8	32	8			
5/11	1	4-F	2	3	Calcareous loam.	3	8	4	11	37	3	Three on— 25th June 1918. 13th July 1918. 18th July 1918.	Five on— 10th July 1918. 20th August 1918. 17th September 1918. 30th September 1918 4th October 1918.	Late sown. Germination good.
	2	280-F	2	3		3	14	12	12	21	6			
	3	4-F	2	3		3	33	4	14	10	3			
	4	280-F	2	3		3	14	10	12	20	15			
5/20	1	4-F	2	4	Calcareous loam.	2	36	11	10	24	5	Three on— 25th June 1918. 13th July 1918. 18th July 1918.	Five on— 10th July 1918. 20th August 1918. 17th September 1918. 29th September 1918. 4th October 1918.	Late sown. Germination good.
	2	280-F	2	4		3	0	1	10	36	9			
	3	4-F	2	4		2	34	8	10	16	6			
	4	280-F	2	4		2	37	9	10	27	8			
6/4	1	4-F	2	4	Calcareous loam.	2	10	11	8	9	12	Three on— 18th June 1918. 19th July 1918. 3rd September 1918.	Two on— 16th June 1918. 16th September 1918.	Late sown. Germination fair. Ditto. Ditto. Late sown. Germination thin.
	2	280-F	2	4		2	30	14	10	3	3			
	3	4-F	2	4		2	30	10	10	2	5			
	4	280-F	2	4		1	31	0	6	18	3			
7/6	1	4-F	2	2	Calcareous loam.	1	39	5	7	22	4	Three on— 2nd July 1918. 21st July 1918. 31st July 1918.	Five on— 29th June 1918. 18th July 1918. 28th July 1918. 20th September 1918. 4th October 1918.	Late sown. Germination fair. Late sown. Germination poor. Late sown. Germination fair. Ditto.
	2	280-F	2	2		1	27	0	6	15	4			
	3	4-F	2	2		2	11	5	8	27	13			
	4	280-F	2	2		1	38	11	7	19	12			
7/19	1	4-F	2	2	Calcareous loam.	2	35	6	10	39	8	Three on— 1st July 1918. 19th July 1918 2nd September 1918.	Three on— 29th June 1918. 20th September 1918. 17th October 1918.	Late sown. Germination fairly good. Ditto. Germination fair. Germination poor and thin.
	2	280-F	2	2		2	23	6	9	33	13			
	3	4-F	2	2		2	7	1	8	11	12			
	4	280-F	2	2		1	19	6	5	26	3			
13/8	1	4-F	2	2	Heavy loam.	1	31	13	6	33	9	Six on— 15th May 1918. 16th May 1918. 28th June 1918. 18th July 1918. 29th July 1918. 5th September 1918.	Six on— 11th May 1918. 25th June 1918. 25th July 1918. 20th August 1918. 17th September 1918. 30th September 1918.	Early sown. Germination rather thin. Germination fairly good. Ditto. Ditto.
	2	280-F	2	2		2	25	13	10	3	1			
	3	4-F	2	2		2	39	15	11	16	14			
	4	280-F	2	2		2	34	9	10	36	6			
13/18	1	4-F	2	2	Heavy loam.	3	0	4	11	18	1	Seven on— 15th May 1918. 16th May 1918 28th June 1918. 14th July 1918. 19th July 1918. 30th July 1918. 6th September 1918.	Seven on— 12th May 1918. 25th June 1918. 11th July 1918. 25th July 1918. 20th August 1918. 17th September 1918. 30th September 1918.	Early sown. Germination fair. Ditto. Ditto. Germination patchy.
	2	280-F	2	2		2	12	1	8	30	11			
	3	4-F	2	2		2	32	9	10	28	12			
	4	280-F	2	2		1	37	13	7	16	6			
16/17	1	4-F	2	3	Heavy loam.	3	28	3	13	31	6	Three on— 28th June 1918. 17th July 1918. 29th July 1918.	Five on— 26th June 1918. 26th July 1918. 18th September 1918. 1st October 1918. 12th October 1918.	Late sown. Germination good.
	2	280-F	2	3		3	16	7	12	27	11			
	3	4-F	2	3		4	38	0	18	16	12			
	4	280-F	2	3		4	20	9	16	31	14			

Average outturn per acre.

	Total area.			*Total yield.*			*Yield per acre.*		
4-F	38	12		54	0	13	11	7	13
280-F	38	12		47	32	0	9	36	4

Average outturn per acre calculated on yield per acre.

	Maunds.	*Seers.*	*Chataks.*
4-F	11	8	2
280-F	9	35	11

Statement No. 43.

SHOWING THE COMPARATIVE RESULTS OF 4-F AND 276-F (AMERICAN COTTON) VARIETIES GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION, KHARIF, 1918.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Irrigation with dates.	Remarks.
6 / 18	1	4-F ...	1	0	Calcareous loam.	1	9	8	9	36	0	Four on— 2nd July 1918.	Five on— 30th May 1918.	Late sown. Germination fair.
	2	276-F	1	7		2	11	3	13	20	6	22nd July 1918.	29th June 1918.	
	3	4-F ...	1	7		2	14	5	13	38	14	25th July 1918. 16th August 1918.	19th July 1918. 13th August 1918.	Late sown. Germination good.
	4	276-F	1	7		2	11	5	13	21	2		4th October 1918.	
17 / 21	1	4-F ...	2	4	Heavy loam.	3	26	0	13	10	15	Four on— 26th June 1918.	Three on— 29th July 1918.	Late sown. Germination good.
	2	276-F	2	4		3	22	3	12	37	1	3rd July 1918.	8th August 1918.	
	3	4-F ...	2	4		2	29	9	9	38	6	18th July 1918. 11th August 1918.	17th September 1918	Late sown. Germination thin.
	4	276-F	2	4		2	2	6	7	19	9			Late sown. Germination fair.
19 / 10	1	4-F ...	1	19	Medium loam.	2	28	1	11	3	5	Four on— 31st May 1918.	Five on— 27th May 1918.	Early sown. Germination thin.
	2	276-F	1	19		2	33	14	11	27	3	31st May 1918.	6th July 1918.	
	3	4-F ...	1	19		1	33	11	7	22	5	9th July 1918. 17th July 1918.	15th August 1918. 22nd September 1918	Early sown. Germination poor.
	4	276-F	1	19		1	25	1	6	26	15		11th October 1918.	
20 / 6	1	4-F ...	2	3	Medium loam.	2	35	9	10	30	0	Five on— 31st May 1918.	Five on— 27th May 1918.	
	2	276-F	2	3		2	16	10	8	39	9	31st May 1918	6th July 1918.	
	3	4-F ...	2	3		2	11	6	8	20	0	9th July 1918. 18th July 1918.	15th August 1918. 22nd September 1918.	Early sown. Germination thin.
	4	276-F	2	3		2	17	3	9	1	10	13th August 1918.	11th October 1918.	

Average outturn per acre.

	Total area.			Total yield.			Yield per acre.			Average outturn per acre calculated on yield per acre. Maunds.	Seers.	Chataks.
4-F ...	14	19		19	28	1	10	21	11	10	24	15
276-F	15	6		19	19	13	10	7	12	10	19	3

Statement No. 44.

SHOWING THE COMPARATIVE RESULTS OF 4-F AND RISALA (AMERICAN COTTON) VARIETIES GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION, KHARIF 1918.

No. of square and plot.	No. of sub-plots.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Irrigation with dates.	Remarks.
3 / 13	1	4-F ...	2	2	Calcareous loam.	1	35	5	7	6	14	Five on— 25th June 1918.	Three on— 19th July 1918.	Late sown. Germination good. Bearing poor.
	2	Risala	2	2		1	27	8	6	17	2	21st July 1918.	12th August 1918.	
	3	4-F ...	2	2		1	38	5	7	18	5	15th August 1918. 1st September 1918.	4th October 1918.	
	4	Risala	2	2		2	15	7	9	3	9	20th September 1918.		
7 / 15	1	4-F ...	1	19	Calcareous loam.	3	25	6	14	36	6	Five on— 14th May 1918.	Six on— 11th May 1918.	Early sown. Germination good.
	2	Risala	1	19		4	0	15	16	20	4	14th May 1918. 18th June 1918.	15th June 1918. 18th July 1918.	
	3	4-F ...	1	19		3	2	14	12	24	1	21st July 1918. 1st August 1918.	28th July 1918. 20th September 1918.	Early sown. Except two or three patches.
	4	Risala	1	19		3	20	14	14	17	0		4th October 1918.	Early sown. Germination good.
10 / 5	1	4-F ...	1	15	Calcareous loam.	1	16	11	6	19	2	Five on— 14th May 1918.	Five on— 11th May 1918.	Early sown. Germination good, but the plants suffered much from intense heat and consequently some plants dried up.
	2	Risala	1	15		1	15	10	6	14	5	14th May 1918. 18th June 1918.	15th June 1918. 26th July 1918.	
	3	4-F ...	1	15		1	15	0	6	11	7	17th July 1918. 30th July 1918.	19th September 1918. 4th October 1918.	
	4	Risala	1	15		1	10	12	5	32	0			
16 / 15	1	4-F ...	1	17	Heavy loam.	2	30	9	11	28	2	Three on— 25th June 1918.	Five on— 12th July 1918.	Late sown. Germination good and regular.
	2	Risala	1	17		2	31	0	12	0	0	18th July 1918.	18th September 1918.	
	3	4-F ...	1	17		3	12	6	14	12	7	5th September 1918.	23rd September 1918. 1st October 1918.	
	4	Risala	1	17		2	39	0	12	34			12th October 1918.	

Average outturn per acre.

	Total area.			Total yield.			Yield per acre.			Average outturn per acre calculated on yield per acre. Maunds.	Seers.	Chataks.
4-F ...	15	6	...	19	16	8	10	6	6	10	5	13
Risala Cotton.	15	6	...	20	1	2	10	18	5	10	17	5

Statement No. 45.

SHOWING THE COMPARATIVE RESULTS OF 4-F AND 285-F (AMERICAN COTTON) VARIETIES GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Irrigation with dates.	Remarks.
	1	4-F ...	2	1		3	17	5	13	15	13	Four on—	Six on—	Late sown. Germination good.
13	2	285-F	2	1	Heavy loam.	2	11	9	8	37	5	28th June 1918.	26th June 1918.	Late sown. Germination thin.
12	3	4-F ...	2	1		3	26	14	14	13	2	18th July 1918.	25th July 1918.	Late sown. Germination good.
	4	285-F	2	1		3	27	14	14	17	1	30th July 1918.	20th August 1918.	Late sown. Germination good.
												4th September 1918.	7th September 1918.	
													30th September 1918.	
													11th October 1918.	
	1	4-F ...	1	19		2	31	0	11	16	11	Six on—	Seven on—	Late sown. Germination fair.
16	2	285-F	1	19	Heavy loam.	2	3	0	8	20	8	28th June 1918.	22nd May 1918.	Late sown. Germination thin.
12	3	4-F ...	1	19		4	19	0	18	14	6	1st July 1918.	25th May 1918.	Late sown. Germination good.
	4	285-F	1	19		2	37	0	12	0	0	19th July 1918.	26th June 1918.	Late sown. Germination fair.
												20th July 1918.	11th July 1918.	
												21st July 1918.	10th September 1918.	
												28th July 1918.	1st October 1918.	
													12th October 1918.	
	1	4-F ...	2	3		4	16	2	16	15	5	Three on—	Five on—	Late sown. Germination good.
17	2	285-F	2	3	Heavy loam.	3	36	11	14	23	0	16th June 1918.	14th June 1918.	Late sown. Germination good except some patches here and there.
22	3	4-F ...	2	3		4	3	0	15	6	8	18th July 1918.	28th July 1918.	
	4	285-F	2	3		4	2	3	15	3	8	1st August 1918.	14th September 1918	Late sown. Germination good.
													23rd September 1918.	Late sown. Germination good except few patches.
													9th October 1918.	
	1	4-F ...	2	8		2	12	1	7	26	14	Three on—	Five on—	Late sown. Germination poor.
19	2	285-F	2	8	Heavy loam.	1	29	8	5	31	11	16th June 1918.	14th June 1918.	Late sown. Germination poor and thin.
18	3	4-F ...	2	8		2	15	1	7	36	14	19th July 1918.	12th July 1918.	Late sown. Germination poor.
	4	285-F	2	8		2	16	10	8	2	1	26th July 1918.	10th September 1918.	Late sown. Germination poor.
													29th September 1918.	
													11th October 1918.	

Average outturn per acre.

	Total area.		Total yield.			Yield per acre.		
4-F ...	17	2	27	32	12	13	0	9
285-F	17	2	23	4	7	10	32	7

Average outtun per acre calculated on yield per acre.

Maunds.	Seers.	Chataks.
13	0	15
10	35	14

Statement No. 46.

SHOWING THE COMPARATIVE RESULTS OF ROSEUM 87 AND NEGLECTUM 109 (DESI COTTON) VARIETIES GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION, KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Irrigation with dates.	Remarks.
	1	Roseum 87 ...	1	11		1	27	2	8	26	7	Five on—	Four on—	Germination poor.
7	2	Neglectum 109	1	10	Calcareous loam.	1	31	14	9	23	5	14th May 1918.	11th May 1918.	Poor Germination.
16	3	Roseum 87 ...	1	10		2	13	5	12	17	11	15th May 1918.	15th June 1918.	Fair Germination.
	4	Neglectum 109	2	1		1	34	15	7	12	7	18th June 1918.	20th August 1918.	Fair Germination.
												19th July 1918.	22nd September 1918	
												3rd September 1918		
	1	Roseum 87 ...	1	17		3	31	3	16	13	12	Two on—	Four on—	Late sown. Germination fair.
16	2	Neglectum 109	1	17	Heavy loam.	2	17	11	10	22	7	24th June 1918.	12th July 1918.	Late sown. Germination fair.
14	3	Roseum 87 ...	1	17		3	3	4	13	13	0	19th July 1918.	18th September 1918	Late sown. Germination fair.
	4	Neglectum 109	1	17		2	1	0	8	30	4		1st October 1918.	Late sown. Germination fair.
													12th October 1918	

Averag cutturn per Acre.

	Total area.		Total yield.			Yield per acre.		
Roseum 87 ...	6	15	10	34	14	12	35	6
Neglectum 109	7	5	8	5	8	9	15	11

Average outturn per acre calculated on yield per acre.

Maunds.	Seers.	Chataks
12	27	12½
9	2	14

Statement No. 47.

SHOWING THE COMPARATIVE RESULTS OF ROSEUM 87 AND MOLLISONI 24 (DESI COTTON) VARIETIES GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION, KHARIF 1918.

No. of square and plot.	No. of sub plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Irrigation with dates.	Remarks.
	1	Mollisoni 24 ...	2	1		2	5	9	8	13	14	Three on—	Five on—	Late sown. Germination fair.
3	2	Roseum 87 ...	2	1	Calcareous loam.	1	32	8	7	2	15	18th June 1918. 25th June 1918.	16th June 1918. 19th July 1918.	Late sown. Germination thin.
18	3	Mollisoni 24 ...	2	1		1	35	8	7	14	10	21st July 1918.	2nd September 1918 20th September 1918	Ditto.
	4	Roseum 87 ...	2	1		1	3	15	4	11	7		4th October 1918.	Ditto.
	1	Roseum 87 ...	1	17		1	14	8	5	35	11	Three on—	Four on—	Late sown. Germination thin.
12	2	Mollisoni 24 ...	1	17		1	14	1	5	33	13	27th June 1918. 19th July 1918.	25th June 1918. 12th July 1918.	Ditto.
1	3	Roseum 87 ...	1	17	Sandy loam.	1	13	5	5	30	8	3rd September 1918	19th August 1918.	Ditto.
	4	Mollisoni 24 ...	1	17		1	9	4	5	12	15		10th October 1918.	Ditto.
	1	Roseum 87 ...	2	0		3	36	12	15	27	0	Three on—	Four on—	Late sown. Germination good and regular.
17	2	Mollisoni 24 ...	2	0		3	39	1	15	36	4	26th June 1918, 16th July 1918.	21st July 1918. 21st August 1918.	Ditto.
11	3	Roseum 87 ...	2	0	Heavy loam.	4	11	15	17	7	12	25th July 1918.	23rd September 1918	Ditto.
	4	Mollisoni 24 ...	2	0		3	30	12	15	3	0		16th October 1918.	Ditto.
	1	Roseum 87 ...	1	15		2	16	10	11	1	14	Four on—	Four on—	Late sown. Germination fairly good.
19	2	Mollisoni 24 ...	1	15	Medium loam.	1	39	7	9	3	2	26th June 1918. 5th July 1918.	24th June 1918. 27th July 1918.	Ditto.
12	3	Roseum 87 ...	1	15		2	7	9	10	0	5	18th July 1918. 1st August 1918.	22nd September 1918 28th September 1918	Ditto.
	4	Mollisoni 24 ...	1	15		1	39	15	9	5	7			Ditto.
	1	Roseum 87 ...	2	8		4	23	7	15	11	7	Four on—	Three on—	Late sown. Germination good.
19	2	Mollisoni 24 ...	2	8	Medium loam.	4	15	12	14	25	13	26th June 1918. 4th July 1918.	24th June 1918. 27th July 1918.	Ditto.
13	3	Roseum 87 ...	2	8		3	26	3	12	7	5	18th July 1918. 1st August 1918.	29th September 1918	Ditto.
	4	Mollisoni 24 ...	2	8		4	7	3	13	37	5			Ditto.
	1	Roseum 87 ...	2	4		3	32	7	13	34	5	Two on—	Four on—	Late sown. Germination good and regular.
17	2	Mollisoni 24 ...	2	4		4	24	0	16	29	1	26th June 1918. 18th July 1918.	12th July 1918. 21st August 1918.	Ditto.
20	3	Roseum 87 ...	2	4	Heavy loam.	4	16	1	16	0	3		23rd September 1918 16th October 1918.	Ditto.
	4	Mollisoni 24 ...	2	4		4	0	8	14	23	10			Ditto.

		Average outturn per acre. Total area.			Total yield.			Yield per acre.		Average outturn calculated on yield per acre. Maunds.	Seers.	Chataks.
	Mollisoni 24 ...	24	10	...	35	21	0	11	24	0	11	13	4
	Roseum 87 ...	24	10	...	34	3	6	11	15	10	11	10	14

Statement No. 48.

SHOWING THE COMPARATIVE RESULTS OF ROSEUM 87 AND SANGUINEUM BROAD LEAVED (DESI COTTON) VARIETIES GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION, KHARIF 1918.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Irrigations with dates.	Remarks.
5	1	Roseum 87 ...	2	3	Calcareous soil.	3	30	5	13	39	5	Four on— 14th May 1918. 15th May 1918. 17th July 1918. 30th July 1918.	Five on— 11th May 1918. 27th July 1918. 20th August 1918. 17th September 1918 30th September 1918.	Early sown. Germination good, but comparatively thin than sanguineum.
	2	Sanguineum Broad leaved.	2	3		3	37	2	14	24	10			Early sown. Germ good and regular
21	3	Roseum 87 ...	2	3		4	12	14	16	3	4			Ditto.
	4	Sanguineum Broad leaved.	2	3		3	32	7	14	7	3			Ditto.
13	1	Roseum 87 ...	1	10	Medium loam.	2	23	11	13	29	5	Three on— 24th June 1918. 13th July 1918. 19th July 1918.	Four on— 11th July 1918. 20th August 1918. 7th September 1918. 30th September 1918.	Late sown. Germination fair.
	2	Sanguineum Broad leaved.	1	10		1	20	5	8	1	11			Ditto.
25	3	Roseum 87 ...	2	1		2	31	0	10	33	3			Ditto.
	4	Sanguineum Broad leaved.	2	1		3	3	13	12	3	3			Ditto.

Variety.	Average outturn per acre. Total area. K.	M.	Total yield. M.	S.	C.	Yield per acre. M.	S.	C.	Average outturn per acre calculated on yield per acre. M.	S.	C.
Roseum 87 ...	7	17	13	17	14	13	28	2	13	26	4½
Sanguineum Broad leaved.	7	17	12	13	14	12	23	2	12	9	2

Statement No. 49.

SHOWING THE OUTTURN OF COTTON VARIETIES TESTED ON TENANTS' AREA, KHARIF 1918.

Serial No.	Variety.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Year of handing over to the Lyallpur Agricultural Station.	Remarks.
1	4-F ...	38	12	54	0	13	11	7	13	1910	
2	280-F ...	38	12	47	32	0	9	36	4	1913	
3	4-F ...	17	2	27	32	12	13	0	9	1910	
4	285-F ...	17	2	23	4	7	10	32	7	1918	
5	4-F ...	14	19	19	28	1	10	21	11	1910	
6	276-F ...	15	6	19	19	13	10	7	12	1918	
7	4-F ...	15	6	19	16	8	10	6	0	1910	
8	Risala American ...	15	6	20	1	2	10	18	14	1917	
9	Roseum 87 ...	24	10	35	39	14	11	30	3	1914	
10	Mollisoni 24 ...	24	10	34	16	6	11	9	7	1914	
11	Roseum 87 ...	6	15	10	34	14	12	35	6	1914	
12	Neglectum 109 ..	7	5	8	5	8	8	39	2	1914	
13	Roseum 87 ...	7	17	13	17	14	13	28	2	1914	
14	Sang. Broad leaved ...	7	7	12	13	11	12	23	2	...	

Experiments at the Gurdaspur Agricultural Station by M. Fateh-ud-Din, Officiating Deputy Director of Agriculture.

Introductory.—I was in charge of the farm throughout the year under report.

For history and objects of the farm please see former reports.

Area.—One hundred and sixty-one acres, of which fourteen acres are under roads and buildings, two acres are pasture, and the remainder is utilised for experimental cultivation, seed selection, varietal and manurial tests, and for the production of fodder and other crops. Fifty seven acres of the above were only recently added.

Season and its effect upon crops. Rainfall (statement 1).—The total rainfall during the year under report was 17·71 against 54·47 of the previous year. It equals to almost half of the normal figure of the place, and this even was not well distributed. The season was very unfavourable for the kharif from start to finish. Though sowing of kharif crops was somehow hazarded, scanty rainfall during the period of growth resulted in the utter failure of the barani kharif crops. In the case of chahi (irrigated) kharif if it were only feasible to resort to timely irrigation, much better results would have been obtained. The centrifugal pump coupled with inferior belting was a great nuisance, and we were further handicapped on account of the constructions and repairs of the main glazed pipes channels. Want of timely irrigation to cane and subsequent appearance of scale insects in frightful plentitude resulted in rather low outturns.

The start of rabi too was not even hopeful. The preparation of seed bed was much interfered with by the outbreak of influenza epidemic and sowings had to be done hurriedly. Then there were no sowing rains and none during the early period of the growth of the crop. The rain in January proved to be a God-send, an improved the condition of the rabi crop considerably. Very good outturns were expected consequently, but the season warmed up in March and a couple of days' hot winds in that month hastened ripening and shrivelled the grain in high-lying places.

The capricious weather in the end of April and throughout the month of May further hampered and delayed threshing operations, and resulted in wastage of grain thereby reducing outturns. It must be observed here that the weather when the rabi harvest is being gathered almost always causes anxiety. There is either a shower of rain or a hail or windstorm. Under such circumstances though all kinds of wheats suffer, but beardless types fare worse—all of them without exception shed their grains more or less. It is therefore very important that apart from other considerations our wheats should be bearded and in our work on seed selection and wheat types an early maturing bearded wheat should be aimed at.

However, a year like this brings out the advantages of deeper and superior cultivation on the farm. While the sowings generally were below normal in barani tracts, on the farm there was plenty of moisture for sowing, conserved from the rains in the earlier months. Every fall had been taken advantage of and no shower, however little, was allowed to be lost, either by evaporation or surface wash. The land on the farm is always kept in a spongy condition and holds every drop that it gets. The statements of results obtained on the barani area will show that nothing better could be expected. The average of barani wheats without the application of any manure works out to be 1,289 lbs. per acre with 1,729 lbs. per acre as the highest outturn. The average outturn of chahi wheats was 2,493 lbs. and the highest was 3,723 lbs. per acre.

Of course in a year like this and under such conditions when in the earlier period of crop there is a lack of surface moisture, the root system is well developed. The roots have to go deep in search of moisture, consequently the stand of the crop and outturns are very good, if only there are any ameliorating conditions later, as were afforded this year by the January rains. The early dry period affects the vegetative growth of the plant which spends all its energies on the reproductive side. It is no wonder, therefore, that the yield of grain is very good everywhere.

Winter was not severe and did not affect either cane or wheat.

Crop pests.—Mites were bad on sugarcane, and hampered the growth a good bit though no great damage was done. Scale insects, however, were very bad and are responsible for reducing the outturn a good deal. Rusts on wheat appeared late, but the attack was meagre except on 20 C which was badly rusted. Smut, however, was bad this year and the attack was abnormal all over the places.

The rotation and details of experiments have been explained in former reports.

Crops. Sugarcane (statement 2).—Under the effect of the season on crops has been explained what sort of treatment could be meted out to this crop. Attacks of mites thwarted the growth and in the end the appearance of scale insects damaged the crop still more. There were 8 varieties under test.

In these tests Behar tops with an outturn of 3,657 lbs. per acre. This is proving a very good productive variety and is getting very popular with the cultivators. There was a very great demand for its seed. Yuba which comes next is almost the same as the Behar, but for its comparatively short stature. J 105 occupies the third place. It is an exceedingly good cane for chewing purposes, and under luxuriant conditions with good manuring and copious irrigation would prove very productive. It may be observed that on the farm it is only customary to grow cane after the removal of senji (melilotus parviflora) without the addition of any other manure, the previous crop of maize being manured, for direct manuring of cane makes the crop late for crushing and gur making. Late ripening, however, is no consideration in chewing varieties. Wild beasts also relish it and it is essential to protect it from their ravages. Suretha is fourth on the list. It begins to deteriorate on account of climatic and seasonal changes unless seed is imported fresh almost every year. Sonabli makes a very bad show through late sprouting and meagre tillerings and has, therefore, been discarded.

Dhaura of Azamgarh and Burli are hardy varieties and do well under barani conditions and in bets where on account of their tough stems and leafy spreading tillers, they do not attract jackals and pigs. J 33 which has been identified by the Assistant to Sugarcane Expert as J 36 is very liable to red-rot, lodges badly and has also been discarded.

Besides these 15 more varieties of thick and thin canes and 17 seedlings of Dr. Barber's selections and crosses were also grown. Some of these seedlings appeared to be very promising and are likely to turn out very good canes well suited for our parts. These will be continued.

Manurial experiments with sugarcane (*statement* 2)—Details and objects of this experiment have been explained in former reports. The first trial with these manures was made in 1915-16. For want of space this experiment cannot be repeated every year, and has been confined to one field where sugarcane comes every third year in rotation.

This year's results do not confirm those of 1916, in which phosphatic manures had done so well, while a nitrogenous manure has fared so much better this year. As has been pointed out before, this experiment must be continued for a number of years to get any definite results as to what sort of manure this crop will respond profitably.

One thing, however, is clear that there does not appear to be much profit in the use of these artificial fertilizers for sugarcane. There is an increase in outturn by the use of certain manures, but the increase does not cover the cost of manuring and justify its use at present. Best results are shown by lime and ammonium sulphate, next comes potassium sulphate and ammonium sulphate followed by complete manure (lime plus ammonium sulphate plus super phosphate plus potassium sulphate). From this it is obvious that in all these there is a common ingredient, *i.e.*, ammonium sulphate, and it is probable that if used alone it might give good results. Its cost, however, should be borne in mind.

For want of space no cultural experiments are done for sugarcane.

Maize Varietal tests (*statement* 6).—In almost all the tests the local variety has given the best results. Peshawari and Kangra white among the others come next. It may be pointed out here that outturn of maize is on the whole very unsatisfactory on the farm. Season was unfavourable, but this is more to be attributed to inadequate manuring. Maize needs and responds to heavy doses.

The object of these trials is to find out a heavy yielding variety, but a short thick stem which can bear a heavy cob is also aimed at as the dry stalks are ordinarily not much used as fodder.

Manurial experiments with maize. (*Statement* 7).—No experiments are being done on manuring this crop particularly. This is however one of the crops in the manurial plots where the value of certain manures and their suitability to our soils and conditions is being tested. These trials will be discussed later under fertilizers and manures. Bone meal in conjunction with farm yard manure seems to be useful for this crop as there is a saving of Rs. 3-3-8 per acre, but cannot yet be recommended. Superphosphate has proved to be hopeless.

Cottons.—Economic Botanist's environment experiment is being continued.

Other kharif crops on the farm were mash, bajra, soybeans and groundnut, all of which failed on account of drought; soybeans, however, more for want of our knowledge and experience of their cultivation.

Potatoes.—For the first year experimental cultivation of potatoes was undertaken to see the effect of soda nitrate manuring on this crop. The planting was late, and with the failure of centrifugal pump it was not possible to irrigate the crop in time. Three maunds of soda nitrate were top dressed per acre besides castor cake used before sowing. Soon after the application of soda nitrate the plants seemed to wither and immediate irrigation along with lime improved the condition of the crop which would otherwise have failed hopelessly. This shows that the dose used was too strong. Outturn was as below :—

Manured with soda nitrate	9,315 lbs per acre.
Without soda nitrate	6,658 lbs per acre.
Increase per acre	2,657 lbs.
2,657 lbs. at Rs. 3-8-0 per 82 lbs.	Rs. 113-6-6
Deduct cost of manure	Rs. 50-8-3
Profit per acre	Rs. 62-14-3

Wheat.—The effect of the season on rabi crops has been discussed in the beginning of this report. The start was bad. There was only 0·75″ of rain in September and none in October. It was, therefore, through the conserved moisture of earlier months that sowings were done. The prevalence of influenza interfered seriously with the final preparation of seed bed, and sowings had to be done very hurriedly. Germination was good, but November and December turned out to be quite dry and caused anxiety for the future of the barani crops. As was feared white ants just then appeared to complete our annoyance. But with 6″ of rain in January things improved considerably. With nearly another inch in February the crop made a good headway, when in March the season warmed up and a couple of days' hot winds affected the crop where moisture was deficient, hastening ripening with shrivelled grains. On the whole the season was quite favourable after January to ensure an extraordinarily good harvest, but for rain and windstorms during the threshing period, which tended to reduce the outturns by blowing or otherwise spoiling the bundles. Outturns on the farm, however, were very good. The average was 1,289 lbs. per acre against 615 lbs. of the district average, while the highest outturn on the farm was 1,724 lbs. for an acre. All these results were obtained without the use of any manure. Manurial plots in barani have given as much as 2,012 lbs. per acre.

In the case of chahi the germination was good all over. Unfortunately owing to the breakdown of the pipe channels it was not feasible to irrigate the crop in fields 5, 10A and 10B when it was needed. Still the crop behaved well. But as ill luck would have it no sooner the first irrigation was given to the varieties in No. 5 than there came a very heavy downpour of over 3″ of rain accompanied by windstorm and the crop lodged all over. It was, however not found possible to give irrigation to Nos. 10A and 10B at the same time. Second irrigation to No. 5 was given in the last week of March, and with some difficulty 10A was given the first watering then, while 10B could not be given even a single watering. Summary of work done on wheat is given hereafter :—

1. *Comparative varietal tests in chahi (irrigated) area (statement 3).*—

The types under test were—

8A, 8B, 17B } Economic Botanist's selections.

Pusa 4, Pusa 12 } Mr. Howard's wheats.

Punjab 11, Punjab 17 } Chief colony wheats.

and these varieties were grown in field No. 5, 10A and 10B. The test was triplicated and the types were interstripped with 8A as standard.

In field No 5 with two irrigations 8A has given the highest outturn per acre ranging generally between 2,577 and 3,014 lbs. Next comes Pusa 12 with 2,225 lbs. per acre. Punjab 11 is very low on the list and so is $NH_4 \times P_6$. In field No. 10A with one irrigation 8A again tops the list with 8B as second, while Pusa 12 is at the bottom. In field No. 10B with no irrigation after sowing (and this crop was practically barani except for the first irrigation before sowing) 8B has given the highest outturn of 3,171 lbs. per acre. On an average in the chahi (irrigated area) the wheats stand as under—

Type No.	*Average outturn per acre.*
8B	2,733 lbs. from 3 plots
8A	2,570 „ „ 23 „
Punjab 17	2,366 „ „ 3 „
Punjab 17B	2,309 „ „ 3 „
Pusa 4	2,302 „ „ 3 „
Pusa 12	2,253 „ „ 3 „
Punjab 11	2,187 „ „ 3 „
$NH_4 \times P_6$	2,069 „ „ 3 „

8A should have been the first, but for its lodging ; also the average of such a large area should naturally come down as compared with the produce of its one-seventh under another variety. Trials shall be made next year of 8A and 8B separately on equal areas. Pusa 12 has come down this year in the chahi, and this too is due to lodging and to a bad bit in field No. 10 where its outturn is hopelessly poor, otherwise it would have attained a much better position.

2. *Comparative varietal tests barani* (*statement* 3).—

The following varieties were under test—

8A
20C
8B
17B
} Mr. Milne's selections.

Pusa 12 of Mr. Howard with Punjab 14 the principal local type as standard. The test was duplicated and the result are as below :—

Type	*Average outturn per acre.*
17B	1,554 lbs. from 2 plots.
8A	1,523 „ „ 2 „
20C	1,493 „ „ 2 „
Pusa 12	1,413 „ from an average of 2 plots.
Punjab 14	1,487 „ „ „ „ „ 11 „
8A	1,351 „ „ „ „ „ 2 „

Again in the recently acquired area Pusa 12, 8A and Punjab 14 were alternated five times with Punjab 14 as standard and gave—

Type	*Outturn.*
Pusa 12	925 lbs. per acre from 4,872 square yards.
8A	914 „ „ „ „ 6,090 „ „
Punjab 14	1,279 „ „ „ „ 12,180 „ „

Some of the types which had done exceedingly well last year fared very badly in the present case. In the case of some so far there is no explanation for such a behaviour, others perhaps can be explained. As remarked last year no definite conclusions can be arrived at with a few short trials. There are the varying seasons besides so many other determining factors that only those on the spot can read them intelligently after a good long experience of these varieties. Pusa 12 which has done so well with the zamindars especially under well irrigation in the Jullundur District has fared rather poorly on the farm in chahi. In the barani even in the old area where very good cultivation was given to the land, it has not done well, while in the new area recently added to the farm (this was cultivators' land adjoining the farm, and was very weedy, before we took it over and was still bad with weeds when under these wheats—this was the first crop grown in it), it has done unexpectedly well. 17B which has done so well in baranis had given very bad results last year, but 2 years ago it did as well as this year. It was then the topmost wheat in the baranis. The behaviours of these wheat have still to be studied.

It is, however, very satisfactory that the new selection 8A which has done so well elsewhere on canals and in chahis has done very well in baranis too, and its distribution can be safely taken up for a white wheat. It will be much liked for its bearded character, for there is a general complaint against the beardlessness of Pusa 12. For a red wheat and for baranis generally there is nothing like Punjab 14. It has stood the test of many years and varying seasons and conditions. Arrangements will also be made to secure a good supply of its seed.

It has been remarked in former reports that Pusa 12 was getting very popular, but as it is beardless and ripens all at once thereby causing inconvenience in harvesting it cannot be grown very extensively and the area under it will always be limited. But whatever the limits it will always be there. The zamindar inspite of all his fidelity to all ideas and things will take up what can be demonstrated as really beneficial to him. He grew barley for early fodder and early grains (this is at least true in these districts). He came across a wheat which could replace barley and give him both early fodder and early grain. He readily took it up and it is for this reason that this wheat is grown, and will continue to be grown.

Besides the above, Mr. Howard's crosses which had been kept on (please see last year's report), and C13 of Mr. Leake's were also grown on the farm. The results will be found in statement 3. Some of these will be discarded while others shall be given another trial. Two of Mr. Howard's crosses $NH_{98} \times P_4$ and $NH_{53} \times P_4$ which have done exceedingly well this year with 3,723 and 3,505 lbs. respectively will be tried on a large scale next year.

3. *Cultivation experiments* (*statement* 4).—The cultivation experiments with wheat consisted of —

(*a*) Harrowing *versus* no harrowing.
(*b*) Sabul plough *versus* desi plough.
(*c*) Raja plough *versus* desi plough.
(*d*) Permanent wheat plot.
(*e*) Permanent wheat and gram plot.

(*a*) Harrowed *versus* unharrowed gave 1,669 and 1,487 lbs. per acre, respectively. This means an increase of 82 lbs. for five extra harrowings given to it. The cost of these 5 harrow-

ings at six annas per harrowing (for a pair of bullocks can be hired at Re. 1-8-0 per diem and can do some 4 acres a day) comes to Re. 1-14-0 against an increase of a maund of wheat which will bring in Rs. 5.

There can be no doubt that harrowing is very beneficial in a year of scanty rainfall like the one under report, though in a year of heavy rainfall like the last its usefulness is still to be worked out. Last year there were no results. It was observed in the field this year that to start with the harrowed plot looked decidedly superior to its unharrowed neighbours; but after the January rains the latter made up their deficiency wonderfully. The good start of the harrowed portion is, however, responsible for the increased outturns. Any way the harrowing of the young crops should invariably be done to be on the safe side. Even if there are later rains to help the unharrowed bits the harrowed ones do not lose and a few harrowings when one owns a harrow and a pair of bullocks are no great trouble or expense. Besides conserving moisture harrowing helps tillerings also.

(*b*) Sabul *versus* country plough gave 1,527 and 1,155 lbs. per acre, respectively. For one sabul ploughing two desi ploughings were given, other operations being the same in each case. The cost and outturn compare as below—

	Rs.	A.	P.
Hire of 4 pairs of bullocks to plough an acre with sabul plough at Re. 1-8-0.	6	0	0
Hire of two pairs of bullocks for an acre for desi plough ...	3	0	0
Extra cost with sabul per acre	3	0	0
Difference of outturn in favour of sabul plough is (1,527—1,155) 372 lbs.			
372 lbs. at Rs. 5 per 82 lbs. would bring in	22	11	0
Deduct extra cost in the use of sabul plough	3	0	0
Profit per acre	19	11	0

Value of straw has been ignored as also depreciation and interest on the money invested in the purchase of sabul plough. The advantages of deep cultivation are apparent in a year of scanty rainfall like the one under report.

(*c*) Country plough *versus* Raja plough gave 1,042 against 1,175 lbs. per acre on an average. Desi plough in this experiment also was used twice for each ploughing with the Raja; other operations were equal. Profit and loss per acre were as below—

	Rs.	A.	P.
Cost of two desi ploughings at Re. 1-8-0 per ploughing per acre	3	0	0
Cost of one Raja ploughing (one pair can plough an acre with Raja plough).	1	8	0
Extra cost against desi plough	1	8	0
Increase in outturn in favour of Raja plough 132 lbs.			
Income of the grain at Rs. 5 per 82 lbs.	8	0	9
Total gain per acre	9	8	9

Here again deeper cultivation has scored. (In the above calculations I have put down the price of wheat by six annas less than what the farm produce was sold at.)

(*d*) Permanent wheat plot has given 1,334 lbs. per acre, and permanent wheat and gram plot 1,316 lbs. The gram in the latter plot was very poor. Their germination was defective.

The permanent wheat experiment has been going on for the last five years. Wheat follows wheat every year. Neither manure nor irrigation is given. All the same successive wheat cropping with good cultivation and preparatory tillage appears to have no deteriorating or injurious effect; a mixture of gram and wheat further is no advantage on an average soil. However both these experiments will be continued for a good number of years to see the effect of successive wheat cropping on the fertility of the soil.

4. *Manurial expeyiments with barani wheats* (*statements* 5*A and* 5*B*).—Superphosphate alone has for the first time given such outstanding results with a profit of Rs. 60 from two acres. This, however, does not justify us to recommend its use at once. Previous trials with this manure have not been so very successful, nor have been

others even this year. We have, however, still to wait and watch how it behaves in future, and also to find out an explanation of this year's exceptional results. Although there is some little loss in the use of bonemeal, yet it is incorrect to judge the results as such, for bonemeal is not a very readily available manure like the phosphate and leaves behind its residual effects for two or three years. These residual effects shall be watched in the coming years.

These very manures combined with another nitrogenous manure have given altogether different results (statement 5*B*) in another field where in each case there has been a loss in their application. Ammonium sulphate alone too has proved no better.

5. *Manurial experiments with chahi (irrigated); wheats (statements 5C and 5D).*—These trials are no more successful than those in the barani (unirrigated) in the previous years. Field No. 9*B* (statement 5*D*) is very badly drained, and those results are not at all to be depended upon. Arrangements are now in progress to drain this field. For detail of the experiments given in statements 5*B*, 5*C*, and 5*D* please see report for 1917.

Other rabi crops on the farm were gram, beet-root and rapes. Varietal trials were carried out with four of Economic Botanist's selections of gram with local seed as standard. Statement 8 gives the results. Economic Botanist's register No. 15, 17, local, 7 and 20/1 are their order of merit for outturn.

Cultivation.—The ordinary cultivation on the farm consists of fairly deep ploughing the land as soon as it can allow the use of a plough after the removal of a crop. Raja plough is generally used for this purpose. It has been found that there is generally enough moisture left in the soil, after a crop has been removed, to enable the working of a cultivator at least.

This cultivation and subsequent ploughing as early as it can be done, allows of no wastage, of any fall that we get. There is, moreover, no surface wash. This ploughing futher helps weathering of the soil by exposure to a severe sun in summer and severe colds in winter. The subsequent operations after a ploughing are to keep a surface mulch by breaking the crust whenever one is formed and the removal of weeds by harrowing and cultivating till a good seed bed is prepared and crop is down. When the seed is sown, a most important operation which is generally missed by the zemindars, especially in the case of rabi, is after cultivation and harrowing young crops This very greatly helps the growth of the crop by breaking the surface crust and allowing a free access of air to roots.

Cultural experiments for wheat which is the principal crop in the baranis in these districts have been explained above. For want of space no such experiments can be undertaken for other crops at present.

Fertilizers and manures.—Experiments with manures have been discussed above under the particular crop to which the manure was applied. Similar experiments with fertilizer for wheat were also carried out with the cultivators outside the farm. Their results corroborate the results obtained on the farm.

I have little to add to what has been said in the former reports. Some of these experiments will have to be continued over a good number of years to get conclusive results, in other cases it will, however, be possible after a few more trials to drop the experiment on account of its success or failure, most probably the latter. For our barani wheats what is wanted is humus and organic matter and its addition in any form by green manuring or otherwise will pay far better than any artificial manure which has to be imported into the country and thereby becomes expensive.

For intensive cultivation as has been the case above with the manurial trials for potatoes, the case however is different, and use of certain manures does pay very well. It is further interesting to add that as in other provinces bonemeal has been found a profitable manure for rice in trials conducted with the zamindars. Its use will be encouraged.

Poultry.—Demand for Leghorns (which was the only breed kept on this farm) continues to increase. Rhode Island Reds and Aylesbury ducks have this year been added. Six Leghorn cockrels were given to Cooperative Societies for the improvement of the local breed through crossing. The results obtained so far in the villages have been very successful.

Visitors.—The farm is now very popular and much frequented for seeds, implements and advice. The visitors are shown round and explained the work in progress. The Commissioner, Lahore Division, Agricultural Officer, North-West Frontier Provinces, Director of Agriculture, Kashmir State, Warden of Fisheries, Punjab, were among the visitors to this farm.

Staff.—Chaudhri Gurdial Singh was Manager of the Station till 19th November 1918 when he was succeeded by M. Mukhtar Nabi. Both of them did very well in the management of the farm and in carrying out the experimental work. Chaudhri Gurdial Singh's transfer left this section one man short; consequently the Gurdaspur District work was made over to M. Mukhtar Nabi in addition to his already heavy farm work, to do the best he could with it.

Acknowledgments.—Mr. M. L. Darling, I.C.S., has taken a very keen interest in the work on the farm, and has always been a very willing helper to bring the results obtained on the farm to the notice of his co-operators. His ever sympathetic and cheerful disposition has brought the two local departments very close together.

General.—The new area (57 acres) which has been recently acquired has been laid out, but it still remains to be tested for uniformity of soil. A good deal of levelling is also necessary and will be done as time and labour permit. Wheat varietal trials have been started in the barani in this area, while in the chahi wheat will be grown as a test crop next rabi.

The new pipe water channels have after all been completed, but after a good deal of damage to our crops and annoyance to ourselves.

Our contrifugal pump was purchased second hand. It is now worn out and causes not infrequently a good deal of trouble. This will have, therefore, to be replaced, and estimates have been asked for from the Canal Workshop, Amritsar. The tube well is working all right, but with the new crushing mill and power driven chaff cutter it will be necessary to go in for a more powerful oil engine. Proposals about this will be submitted after consultation with the Agricultural Engineer.

GURDASPUR:
The 1st August 1919.

FATEH-UD-DIN,
Deputy Director of Agriculture, 1st Circle.

Statement No. 1.

RAINFALL.

Rainfall during the year 1917-18.		Rainfall during the year 1918-19.		Remarks.
Month.	Rainfall in inches.	Month.	Rainfall in inches.	
July 1917	15·14	July 1918	2·27	
August 1917	14·14	August 1918	3·80	
September 1917	8 15	September 1918	0·75	
October 1917	6·75	October 1918	...	
November 1917	...	November 1918	0·28	
December 1917	0·62	December 1918	0·36	
January 1918	...	January 1919	6·08	
February 1918	0·08	February 1919	0·94	
March 1918	2·90	March 1919	0·35	
April 1918	2·73	April 1919	0·17	
May 1918	...	May 1919	2·06	
June 1918	1·96	June 1919	0·65	
Total ...	52·47	Total ...	17·71	

Statement No. 2 A.

TESTS OF SUGARCANE VARIETIES.

No. of field.	Name of variety.	Area harvested in square yards.	Weight of canes in lbs.	Weight of juice in lbs.	Weight of gur in lbs.	Weight of canes per acre in lbs	Weight of juice per acre in lbs.	Weight of gur per acre in lbs.	Per cent. of juice to canes.	Per cent. of gur to juice.	Per centi of gur to canes.	Remarks.
I	Behar ...	605	5,229	2,706	457	41,832	21,648	3,656	51·74	16 88	8·74	A very good and productive variety.
I	Yuba ...	605	3,663	2,153	359	31,704	17,224	2,872	54·32	16·67	9·05	But for its comparatively short stature it resembles Behar.
I	J 105 ...	605	4,268	2,091	344	34,144	16,728	2,752	48·99	16·43	8·05	Very good for chewing purposes: responds to good and luxuriant cultivation, depredated by wild beasts, requires copious irrigation.
I	Sonabeli ...	605	3,421	1 558	269	27,368	12,464	2,152	45·54	17·27	7 86	Very late in sprouting, tillers badly discarded.
I	Suretha ...	302	1,552	902	164	24,873	14,456	2,628	58·11	18·18	10·56	Bushy but changing requires fresh importing of seed.
I	Dhaura of Azamgarh.	605	2 321	984	172	18,568	7,872	1,376	42·39	17·47	7·41	A likely variety for barani tracts and bets. less liable to depredation of wild beasts. Gur of good quality.
I	Burli ...	605	2,376	902	161	19,008	7,216	1,288	37·96	17·84	6·77	Almost similar to Dhaura.
I	J 33 ...	302	1,394	625	90	22,341	10,016	1,412	44·83	14·4	6·45	Very liable to red rot, lodges badly, discarded.

Statement No. 2 B.

SHOWING THE RESULTS OF MANURIAL EXPERIMENTS.

No. of field.	Name of variety.	Area harvested in square yards.	Weight of canes in lbs.	Weight of juice in lbs.	Weight of Gur in lbs.	Weight of Shakkar in lbs.	Weight of canes per acre in lbs.	Weight of juice per acre in lbs.	Weight of Gur in lbs.	Percentage of juice to canes.	Percentage of Gur to juice.	Percentage of Shakkar to juice.	Percentage of Gur to canes.	Increase or decrease per acre in lbs.	Price of Gur @ Rs. 7-10-0 per maund.	Price of manure.	Profit or loss per acre.	Remarks.
															Rs. A. P.	Rs. A. P.	Rs. A. P.	
			5,953	2,583	410	...	27,519	11,941	1,895	43·39	15·87	...	6·88		...	...	...	Unmanured.
			6,150	2,952	554	...	28,430	13,647	2,561	48·00	18·77	...	9·00	+911	+84 11 5	77 11 10	+6 15 7	Lime 2,000 lbs. per acre and ammonium sulphate 200 lbs. per acre.
			6,387	2,788	431	...	29,525	12,888	1,992	43·65	15·46	..	6·74	...	...	...	...	Unmanured.
			5,258	2,009	418	...	24,306	9,287	1,932	38·20	20·81	...	7·95	—58	—5 9 3	30 5 8	—35 14 11	Potassium sulphate 200 lbs. super 200 lbs.
			6,701	2,460	457	...	30,977	11,372	2,112	36·71	18·57		6·81	+120	+11 2 6	108 1 6	—96 15 0	Lime 2,000 lbs. per acre, ammonium sulphate 200 lbs. super 200 lbs., potasium 200 lbs.
			5,054	1,963	258	...	23,363	9,098	1,193	38·94	13·11	...	5·10	−799	—74 4 9	30 5 8	−104 10 5	Potassium sulphate 200 lbs. per acre super 200 lbs.
			4,742	2,009	281	...	21,921	9,287	1,299	42·37	1398	...	5·92	..	...	...	...	Unmanured.
			4,408	1,753	310	...	20,377	8,104	1,433	39·76	17·68	...	7·00	+134	+12 7 4	77 11 10	−65 4 6	Lime 2,000 lbs. per acre, ammonium sulphate 200 lbs.
2	Dhaulu	1,047	4,473	1,968	289	...	20,677	9,098	1,336	44·00	14·68	...	6·46	...	...	...	...	Unmanured.
			4,535	1,993	308	...	20,964	9,213	1,424	43·94	15·46	...	6·79	...	...	...	...	Do.
			4,264	1,784	289	...	19,711	8,247	1,336	41·83	16·19	...	6·77	—88	—8 3 0	33 0 7	—41 3 7	Lime 2,000 lbs. per acre super 200 lbs.
			5,135	2,092	336	...	23,738	9,671	1,553	40·74	16 5	...	6·54	.	...	...	..	Unmanured.
			5,679	2,276	431	...	26,252	10,519	1,992	40·07	18·93	...	7·59	+439	+40 13 2	75 0 11	—34 3 9	Potassium sulphate 200 lbs., ammonium sulphate 200 lbs.
			5,709	2,583	428	...	26,391	11,941	1,979	45·24	16·57	...	7·49	+426	+39 9 9	108 1 6	—68 7 9	Lime 2,000 lbs., super 200 lbs., ammonium sulphate 200 lbs., potassium sulphate 200 lbs.
			6,361	2,973	500	...	29,405	13,743	2,311	46·73	16·81	...	7·85	+758	+70 7 9	75 0 11	−4 9 2	Potassium sulphate 200 lbs., ammonium sulphate 200 lbs.
			5 457	2,329	361	...	25,226	10,766	1,669	42·67	15·50	...	6·61	...	...	...	...	Unmanured.
			4,828	2,173	314	...	22,319	10,045	1,451	45·00	14·44	...	6·50	—218	—20 4 4	33 0 7	—53 4 11	Lime 2,000 lbs. per acre, super 200 lbs.
			4,364	1,989	316	...	20,173	9,194	1,461	45·57	15·87	...	7·24	.	...	...	...	Unmanured.

Statement No. 3.

COMPARATIVE TESTS OF WHEAT.

No. of field.	Area harvested in square yards.	Name of variety.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
			Grain.	Straw.	Grain.	Straw.	
CHAHI.							
5	708	8-A ...	316	871	2,160	5,954	Raja plough ... ... 2 Sohaga ... ... 5 Wheat harrowing ... ... 3 Date of sowing,—23rd October 1918. Date of harvesting,—17th April 1919. Irrigation, 2, besides one for sowing.
		Pusa 4 ...	336	738	2,297	5,045	
		8-A ...	385	1,043	2,632	7,130	
		Punjab 11 ...	270	813	1,846	5,558	
		8-A ...	383	978	2,618	6,686	
		N. H.$_4$ × P.$_6$ ...	303	879	2,071	6,009	
		8-A ...	279	1,002	2,591	6,850	
		17-B ...	336	912	2,297	6,235	
		8-A ...	398	1,310	2,721	8,956	
		Pusa 12 ...	369	1,013	2,522	6,925	
		8-A ...	420	1,109	2,871	7,581	
		8-B ...	361	1,195	2,468	8,169	
		8-A ...	377	1,386	2,577	9,475	
		Punjab 17 ...	349	1,203	2,386	8,224	
		8-A ...	441	1,406	3,015	9,612	
		Pusa 4 ...	357	791	2,440	5,407	
		8-A ...	390	1,031	2,666	7,048	
		Punjab 11 ...	357	882	2,440	6,029	
		8-A ...	353	1,130	2,413	7,725	
		N. H.$_4$ × P.$_6$ ...	287	966	1,962	6,604	
		8-A ...	267	1,240	1,825	8,477	
		17-B ...	344	879	2,352	6,009	
		8-A ...	385	1,142	2,632	7,807	
10-A	906	8-A ...	426	1,263	2,276	6,747	Raja plough ... ... 2 Sohaga ... ... 5 Country plough ... ... 2 Irrigation, 1, besides one for sowing.
		17-B ...	426	1,269	2,276	6,779	
		8-A ...	398	1,351	2,126	7,217	
		Pusa 12 ...	344	832	1,837	4,444	
		8-A ...	508	1,306	2,714	6,977	
		8-B ...	480	1,134	2,565	6,058	
		8-A ...	492	1,482	2,628	7,917	
		Punjab 17 ...	422	1,230	2,254	6,571	
		8-A ...	431	1,617	2,300	8,638	
10-B	613	8-A ...	209	810	1,650	6,395	Proximity to trees meagre, germination and retarded growth.
		Pusa 12 ...	299	611	2,361	4,824	
		8-A ...	320	947	2,527	7,477	
		8-B ...	402	730	3,174	5,764	
		8-A ...	336	972	2,653	7,674	
		Punjab 17 ...	312	822	2,463	6,490	
		8-A ...	338	847	2,669	6,687	Cultivation as in 10-A.
		Pusa 14 ...	275	631	2,171	4,982	Irrigation none, except one for sowing.
		8-A ...	328	873	2,590	6,893	
		Punjab 11 ...	287	925	2,266	7,303	
		8-A ...	279	1,072	2,203	8,466	
		N. H.$_4$ × P.$_6$ ...	275	857	2,171	6,767	
		8-A ...	349	972	2,756	7,675	
6-B	464	N. H.$_{30}$ × P.$_4$	246	666	2,566	6,947	Kept on for another trial.
		N. H.$_5$ × P.$_6$ ...	221	783	2,305	8,168	Discarded.
		N. H.$_{48}$ × P.$_4$ ...	260	652	2,712	6,801	Kept on for another trial.
		13-W ...	238	672	2,483	7,010	Discarded.
		13-C ...	266	605	2,775	6,311	Kept on for another trial.
		N. H.$_{165}$ × P.$_4$	262	689	2,733	7,187	Ditto. ditto
		N. H.$_{40}$ × P.$_4$ ...	213	748	2,222	7,803	Discarded.
		N. H.$_{98}$ × P.$_4$ ...	357	828	3,723	8,637	Very promising wheat, will be tried on a larger scale next year.
		N. H.$_{53}$ × P.$_4$ ...	336	703	3,505	7,333	Ditto ditto.

Statement No. 3—*concluded.*

COMPARATIVE TESTS OF WHEAT—CONCLUDED.

No. of field.	Area harvested in square yards.	Name of variety.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
			Grain.	Straw.	Grain.	Straw.	
		BARANI.					
16	811	Punjab 14 ..	271	1,132	1,617	6,756	Rusted.
		20-C ...	279	933	1,665	5,568	Badly rusted.
		Punjab 14 ...	234	1,109	1,396	6,618	Rusted,
		8-B ...	225	765	1,343	4,565	
		Punjab 14 ...	258	855	1,541	5,103	
		17-B ...	254	758	1,516	4,524	Rusted.
		Punjab 14 ...	246	806	1,468	4,810	
		Pusa-12 ...	238	539	1,420	3,217	
		Punjab 14 ...	201	695	1,200	4,148	
		8-A ...	264	666	1,576	3,975	
		Punjab 14 ...	221	537	1,319	3,205	Rusted.
		20-C ...	221	568	1,319	3,390	Badly rusted.
		Punjab 14 ...	236	621	1,408	3,706	Rusted.
		8-B ...	230	613	1,373	3,658	
		Punjab 14 ...	287	763	1,713	4,554	
		17-B ...	267	715	1,594	4,267	
		Punjab 14 ...	262	695	1,564	4,148	
		Pusa 12 ...	236	500	1,408	2,984	
		Punjab 14 ...	267	648	1,593	3,867	
		8-A ...	246	701	1,468	4,184	
		Punjab 14 ...	258	738	1,540	4,404	
New area.							
10	12,180	Punjab 14 ...	3,221	6,185	1,280	2,458	
5	6,090	8-A ...	1,152	3,641	916	2,894	
4	4,872	Pusa 12 ...	941	1,978	925	1,965	

Statement No. 4.

EFFECTS OF CULTIVATION ON WHEATS.

No. of field and plot.	Area harvested in square yards.	Name of variety.	Cultivation.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
				Grain.	Straw.	Grain.	Straw.	
17 / 1, 2	3,224	P. wheat plot Pusa 12	...	882	2,079	1,324	3,121	
18 / 1, 2	3,276	P. wheat and gram plot	...	892	2,622	1,318	3,874	
18 / 3, 5, 7	2,457	Pusa 12	Unharrowed ...	800	1,683	1,576	3,316	
18 / 3, 5, 7	2,457	17-B.	Ditto ...	812	2,157	1,600	4,249	
18 / 4, 6, 8	2,457	Pusa 12	Harrowed ...	875	1,795	1,724	3,477	
18 / 4, 6, 8	2,457	17-B.	Ditto ...	820	2,265	1,615	4,462	
18 / 9, 11, 13	2,329	Pusa 12	Sabul plough ...	681	1,591	1,415	3,306	
18 / 9, 11, 13	2,457	17-B.	Ditto ...	832	2,232	1,639	4,397	
18 / 10, 12, 14	2,297	Pusa 12	Country plough ...	529	1,263	1,115	2,661	
18 / 10, 12, 14	2,457	17-B.	Ditto ...	607	1,156	1,196	2,277	
14 / 1, 3	2,682	8-A	Raja plough ...	754	1,997	1,361	3,604	
14 / 1, 3	2,682	8-A	Country plough ...	664	1,863	1,198	3,362	
14 / 2, 4	2,646	Pusa 12	Raja plough ...	541	1,501	990	2,746	
14 / 2, 4	2,646	Ditto	Country plough ...	484	1,183	886	2,164	

Statement No. 5 A.

EFFECT OF BONEMEAL AND SUPER ON WHEAT IN BARANI.

1	2	3	4	5		6		7		8	9	10	11	12	13
No. of field and plot.	Name of variety.	Area harvested in square yards	Previous treatment	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease per acre in lbs.		Price of grain at Rs. 5-6-0 per maund.	Price of straw at Re. 0-8-0 per maund.	Total of columns 8 and 9.	Price of manure.	Profit or loss per acres.	Remarks.
				Grain.	Straw.	Grain.	Straw.	Grain.	Straw.						
										Rs. A. P.	Rs. A. P.	Rs. A. P	Rs. A. P.	Rs. A. P. Rs. A. P.	
18 15, 17, 19	Pusa 12	2,457	Bonemeal 5 cwt. per acre.	933	2,155	1,838	4,245	+331	+363	+21 11 1	+2 3 5	+23 14 6	30 0 0	−6 1 6	
18 15, 17, 19	17-B	2,457	Ditto ...	939	2,825	1,849	5,565	+379	+1,592	+24 13 6	+9 11 4	+34 8 10	30 0 0	+4 9 10	−1 7 8
18 16, 18, 20	Pusa 12	2,457	No manure ...	765	1,970	1,507	3,882	...	...	...	...	...	...	...	
18 16, 18, 20	17-B	2,457	Ditto ...	746	2,017	1,470	3,973	...	...	...	...	...	...	...	
18 21, 23	Pusa 12	1,638	Super ½ cwt. per acre.	517	1,453	1,528	4,344	+293	+1,389	+19 3 3	+8 7 6	+27 10 9	10 13 3	+16 13 6	
18 21, 23	17-B	1,638	Ditto ...	681	1,632	2,012	4,822	+715	+1,199	+46 13 10	+7 5 0	+54 2 10	10 13 3	+43 5 7	+60 3 1
18 22, 24	Pusa 12	1,638	No manure ...	418	1,000	1,235	2,955	...	...	...	...	...	...	...	
18 22, 24	17-B	1,638	Ditto ...	439	1,226	1,297	3,623	...	...	...	...	...	...	...	

Raja plough ... 3
Spring toothed harrow... 12
Country plough ... 4
Sohaga ... 6
Wheat harrowing ... 4
Date of sowing,—25th Octr. 1918.
Date of harvesting,—17th April 1919.

STATEMENT No. 5-B.

SHOWING THE RESULTS OF BONEMEAL, SUPER IN CONJUNCTION WITH AMMONIUM SULPHATE ON WHEAT IN BARANI.

No. of field.	Area harvested in square yards.	Treatment.	Name of variety.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease per acre in lbs.		Price of grain at Rs. 5-4-0 per maund.	Price of straw at Rs. 0-2-0 per maund.	Total.	Price of manure.	Profit or loss per acre.	Remarks.
				Grain.	Straw.	Grain.	Straw.	Grain.	Straw.						
										Rs A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
21	752	Control	Punjab 14.	139	568	895	3,656	...	...	...	...	...	...	...	Raja plough ... 2 S. T. Harrow ... 5 Country plough ... 2 Sohaga ... 6 Wheat harrowing 4 Date of sowing,—7th November 1918. Date of harvesting.—25th April 1919.
		Ammonium Sulphate		277	586	1,783	3,772	+883	+116	+56 13 8	+0 11 3	+57 8 11	25 7 4	+32 1 7	
		Ammonium + superphost 15 lbs. P_2O_5. per acre.		189	851	1,216	5,477	+321	+1,821	+20 8 9	+11 1 8	+31 10 5	28 13 1	+2 13 4	
		Ammonium + bonemeal 15 lbs. P_2O_5. per acre.		148	683	953	4,396	+58	+740	+3 11 5	+4 8 2	+8 3 7	28 12 9	−20 9 2	
		Control		160	625	1,030	4,023	...	...	...	...	...	...	...	
		Ammonium + Sulphate ...		152	582	978	3,746	−52	−277	−3 5 3	−1 2 9	−4 8 0	25 7 4	−29 15 4	
		Ammonium + superphosphate 15 lbs. P_2O_5.		176	867	1,133	5,580	+103	+1,557	+6 9 6	+9 7 11	+16 1 5	28 13 1	−12 11 8	
		Ammonium + bonemeal ...		197	779	1,266	5,014	+236	+891	+15 1 9	+6 0 8	+21 2 5	28 12 9	−7 10 4	
		Control		217	808	1,396	5,200	...	...	...	...	...	...	...	
		Ammonium Sulphate... ...		238	730	1,532	4,698	+136	−502	+8 11 4	−3 0 11	+5 10 5	25 7 4	−19 12 11	
		Ammonium + Super 15 lbs P_2O_5.		201	1,027	1,294	6,610	−102	+1,410	−6 8 6	+8 9 7	+2 1 1	28 13 1	−26 12 0	
		Ammonium + bonemeal ...		226	859	1,455	5,529	+59	+329	+3 12 5	+2 0 1	+5 12 6	28 12 9	−23 0 3	

Statement No. 5-C.

SHOWING THE RESULTS OF RESIDUAL EFFECT OF BONEMEAL IN CONJUNCTION WITH GREEN MANURE IN *CHARI*.

1	2	3	4	5		6		7		8	9	10	11	12	13
No. of field.	Name of variety.	Area harvested in square yards.	Treatment.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease per acre in lbs.		Price of grain at Rs. 5-6-0 per maund.	Price of straw at Re. 0-8-0 per maund.	Total of 8·9.	Price of manure.	Profit or loss per acre.	Remarks.
				Grain.	Straw.	Grain.	Straw.	Grain.	Straw.						
										Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
	8-A×N H_4×P_6	750	Unmanured	328	1,183	2,117	7,634	...	...	...	...	...	...	...	
	Ditto	750	Green manured	338	1,093	2,181	7,053	...	...	...	...	...	...	...	
	Ditto	750	Green manured+super 20·76 lbs. P_2. O_5. per acre.	328	1,324	2,117	8,544	—64	+1,491	—4 3 1	+9 1 5	+4 14 4	5 8 9	—0 10 5	
	Ditto	750	Green manured+bonem al 20·76 lbs. P_2. O_5. per acre.	326	1,080	2,104	6,970	—77	—83	—5 0 9	—0 8 1	—5 8 10	5 9 8	—11 2 6	
	Ditto	750	Green manure	324	1,248	2,091	8,054	...	...	...	...	...		...	
	Ditto	750	Green manure + super 20 lbs. P_2. O_5. per ac e.	296	1,316	1,910	8,493	—181	+439	—11 13 9	+2 10 9	—9 3 0	5 8 9	—14 11 9	
	Ditto	750	Green manure + bonemeal ...	303	1,300	1,955	8,389	—136	+335	—8 14 7	+2 1 7	—6 13 0	5 9 8	—12 6 8	
	N H_4×P_6 ...	375	Unmanured	152	598	1,962	7,589	...	...	...	...	...	...	...	
	8-A ...	375	Ditto	176	594	2,272	7,667	...	...	...	...	...	...	...	Raja plough ... 1
	N H_4×P_6 ...	375	Green manure	160	449	2,065	5,795	...	...	...	...	...	...	...	Spring toothed harrow 2
8-B	8-A ...	375	Ditto	178	644	2,297	8,312	...	...	...	...	...	...	...	Wheat harrowing... 4
	N H_4×P_6 ...	375	Green manure + super phosphate.	156	594	2,013	7,667	—284	—645	—18 9 10	+3 14 11	—22 8 9	5 8 9	—28 1 6	Two waterings, besides one for sowing.
	8-A ...	375	Ditto ditto.	172	730	2,220	9,422	—77	+1,110	—5 0 9	+6 12 3	+1 11 6	5 8 9	—3 13 3	
	N H_4×P_6 ...	375	Green manure + bonemeal ...	143	492	1,846	6,350	—451	—1,962	—29 9 0	—11 15 5	—41 8 5	5 9 8	—47 2 1	
	8-A ...	375	Ditto do. ...	182	588	2,349	7,589	+52	—723	+3 6 6	—4 6 6	—1 0 0	5 9 8	—6 9 8	
	N H_4×P_6 ...	375	Green manure	143	527	1,846	6,802	...	...	...	...	...	...	...	
	8-A ...	375	Ditto	180	722	2,323	9,319	...	...	...	...	...	...	...	
	N H_4×P_6 ...	375	Ditto	148	594	1,910	7,667	—413	—1,652	—27 1 2	—10 1 2	—37 2 4	5 8 9	—42 11 1	
	8-A ...	375	Ditto	143	722	1,846	9,313	—477	—6	—31 4 3	—0 0 7	—31 4 10	5 8 9	—36 13 7	
	N H_4×P_6 ...	375	Green manure + bonemeal ...	152	627	1,962	8,092	—361	—1,227	—23 10 7	—7 7 8	—31 2 3	5 9 8	—36 11 11	
	8-A ...	375	Ditto do. ...	152	672	1,962	8,673	—361	—646	—23 10 7	—3 15 0	—27 9 7	5 9 8	—33 3 3	

Statement No. 5-D.

SHOWING THE RESIDUAL EFFECT OF MANURES (SUPER PHOSPHATE AND BONEMEAL) IN CONJUNCTION WITH FARM YARD MANURE ON WHEAT.

No. of field.	Area harvested in square yards.	Previous treatment.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease per acre in lbs.		Price of grain at Rs. 6 8-0 per maund.	Price of straw at Re. 0-8-0 per maund.	Total profit or loss from wheat.	Profit or loss of the previous crop.	Total net profit or loss from the experiment.	Remarks.
			Grain.	Straw.	Grain.	Straw.	Grain.	Straw.						
									Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
9-B	671	Farmyard manure 41 lbs.	131	392	945	2,828	...	...	...	...	...	...	...	Country plough ... 3 S. toothed harrow ... 1 Sohaga ... 3 Wheat harrowing ... 3 Date of sowing,—10th November 1918. Date of harvesting,—24th April 1919.
	671	Farmyard manure bone meal 30 lbs., P_2O_5 per acre.	135	398	974	2,871	+29	+43	+1 14 5	+0 4 2	+2 2 7	+3 3 8	+5 6 3	
	671	Farmyard manure, super-30, P_2O_5 per acre.	127	353	916	2,546	—29	—282	—1 14 5	—1 11 6	—3 9 11	—12 13 8	—16 7 7	
	671	Farmyard manure 41 lbs. N. per acre	119	336	858	2,424	...	...	...	...	...	...	...	
	671	Farmyard bonemeal 30 lbs. P_2O_5 per acre.	133	379	959	2,734	+101	+310	+6 10 0	+1 14 3	+8 8 3	—10 8 10	—2 0 7	
	671	Farmyard superphost. 30 lbs. P_2O_5 per acre.	123	328	887	2,366	+29	—58	+2 0 6	—0 5 9	+1 10 9	—44 8 8	—42 13 11	

Statement No. 6.

COMPARATIVE TESTS OF MAIZE VARIETIES.

No. of field.	Area harvested in square yards.	Name of variety.	Actual outturn in lbs.	Outturn per acre in lbs.	Remarks.
3	1,700	Local	333	948	
3	1,700	American	323	928	
3	1,700	Local	469	1,335	
3	1,700	Peshawari	297	845	
3	1,700	Local	236	671	
3	1,700	Sargodha	115	327	
3	1,700	Local	453	1,289	Raja plough 1
3	1 700	Kangra, red	273	777	
3	1,700	Local	488	1,389	Country plough ... 2
3	1,700	Kangra, white	367	1,045	
3	1,700	Local	469	1,335	Sohaga 6
3	1,700	Jaunpur	133	379	
3	1,700	Local	398	1,133	S. toothed harrow ... 4
4	1,672	Local	523	1,513	
4	1,672	American	180	521	Hoeing 3
4	1,672	Local	289	836	
4	1,672	Peshawari	426	1,233	Date of sowing,—6th July 1918.
4	1,672	Local	697	2,017	
4	1,672	Sargodha	374	1,082	Date of harvesting—7th October 1918.
4	1,672	Local	341	966	
4	1,672	Kangra, red	385	1,114	
4	1,672	Local	412	1,193	
4	1,672	Kangra, white	180	521	
4	1,672	Local	451	1,305	
4	1,672	Jaunpur	303	877	
4	1,672	Local	191	553	

Statement No. 7.

SHOWING THE RESULTS OF SUPER BONEMEAL IN CONJUNCTION WITH FARMYARD MANURE ON MAIZE.

No. of field.	Area harvested in square yards.	Name of variety.	Treatment.	Actual outturn in lbs.	Outturn per acre in lbs.	Increase or decrease per acre in lbs.	Price of grain at Rs. 4-12-0.	Price of manure	Profit or loss per acre.	Remarks.
							Rs. A. P.	Rs. A P	Rs. A. P.	
9-B	671	Local	Farmyard manure, 40 lbs. N per acre.	168	1,212	...	...	...	...	
9-B	671	,,	Farmyard manure and bonemeal, 30 lbs. $P_2 O_5$ per acre.	189	1,363	+151	+8 11 11	5 8 3	+3 3 8	Raja plough 1
9-B	671	,,	Farmyard manure and super, 30 lbs. $P_2 O_5$, per acre.	152	1,095	—117	—6 12 5	6 1 3	—12 13 8	Country plough 2
9-B	671	,,	Farmyard, 40 lbs. N per acre.	166	1,197	...	...	...	...	S. toothed harrow ... 2
9-B	671	,,	Farmyard and bonemeal. 30 lbs., $P_2 O_5$, per acre.	154	1,110	—87	—5 0 7	5 8 3	—10 8 10	Sohaga 5
9-B	671	,,	Farmyard and Super, 30 lbs., $P_2 O_5$, per acre.	74	533	—664	—38 7 5	6 1 3	—44 8 8	Hoeing 4

Statement No. 8.

GRAM VARIETIES.

No. of field.	Area harvested in square yards.	Name of variety.	Actual outturn in lbs.	Outturn per acre in lbs.	Remarks.
22	5,663	Local	2,509	2,144	Raja plough 1
22	999	Register No. 15	463	2,243	Country plough 2
22	1,142	,, ,, 17	529	2,242	Spring toothed harrow ... 5
22	1,327	,, ,, 20	547	1,995	Sohaga 5
22	1,488	,, ,, 7	615	2,000	Harrowing 3
New area	39,031	Local	14,168	1,757	Date of sowing,—2nd October 1918.
					Date of harvesting,—19th April 1919.

Experiments at the Sargodha Seed Farm, by M. Fateh-ud-din, Deputy Director of Agriculture.

General.—I have been in charge of this farm throughout the year under report. A brief history and the object of this farm were given in the last year's report.

The farm was established in 1913 as a seed farm to grow, multiply and supply pure seeds of wheat and cotton to the Lower Jhelum Colony; but in 1917-18 a part of it was set aside for experimental work and varietal trials of wheats and cottons. The farm is therefore now a combined experimental and seed farm; serving at the same time as Demonstration farm too.

Area.—157 acres, 45 acres are under our direct cultivation where experimental work is carried on and 112 acres are with the tenants who grow the seeds for us.

Soil.—The soil of this farm varies from clay loam to sandy loam and is quite average and representative of the tract.

The table below gives the rainfall during the year:—

July, 1918 ...	...	1·90″	January, 1919 ...	...	0·89″
August, 1918 ...	...	1·77″	February, 1919 ...	...	0·07″
September, 1918	...	0·82″	March, 1919 ...	...	0·00″
October, 1918...	...	0·05″	April, 1919 ...	...	0·44″
November, 1918	...	0·00″	May, 1919 ...	...	0·64″
December, 1918	...	0·28″	June, 1919 ...	...	0·00″

Though rain should not be of very great consequence in canal-irrigated places, yet the vagaries of canal are as annoying as the uncertainty and bad distribution of rainfall. Rain therefore whenever it comes is almost always welcome and a great help generally in such a place. But the year under report was very dry throughout, and exceptionally during the Rabi. The summer was severe and affected young cottons and spoiled their stand. The crop consequently was generally thin. May and June were very sultry and owing to excessive heat there was too much transpiration, resulting in crumpled leaves, while good many of the young seedlings succumbed to its severity. Whenever irrigation was available, it greatly helped. The Rabi had no better fate. There was no rain at the sowing time and the season was throughout dry, while the severe outbreak of influenza hampered preparation and delayed sowings.

Pests.—There was no bad attack of any pest, except that root-rot in cottons was bad as usual and the attack of smut was abnormal.

Experimental work.—The experimental work on this farm consists of—

(1) Seed selection.

(2) Trial of various wheat types and cotton varieties with the object of yield determination and to find out the best suited and best returning types for the colony. This work is more or less a duplication of the work done by the Professor of Agriculture, and the Economic Botanist at Lyallpur in that line to corroborate their results. It has the advantage of the test being done in the very tract where these varieties have to be recommended.

(3) Cultivation experiment.

(4) Trials with minor crops, and

(5) Water saving experiments to find out the minimum quantity of water required to get the maximum of outturn.

The laying out of the experimental area is complete, but in so doing plots under different forms of cultivation and of unequal fertility had to be brought together with the result that the soil of each field is not quite uniform in quality. At the same time some levelling had to be done and is still in progress. These inequalities of the soil combined with some slight defective levels have to some extent affected the results obtained; efforts, however, were made to minimise these defects by keeping the plots under varieties quite narrow and long, and interstripping them with one standard type; also by giving soils of equal character to the different types and varieties grown. The results, therefore, are not quite conclusive but are not far from right and are quite reliable. However, in judging these various types and varieties tried at the farm the above should be borne in mind.

Cottons.—There were 6 varieties under test which was duplicated. These were 3 Americans (4-F, 280-F and 285-F—all Economic Botanist's selections) and 3 desis (Khanna, a mixture, 40 Rosea and 20 Mollisonia, the latter two are also Economic Botanist's selections).

The year under report gave an exceptionally bad start to the cottons. The germination was good, but just three weeks after this temperature rose very high and transpiration was very rapid resulting in the crumpling of tender leaves and in many cases drying and destroying the young seedlings altogether. The crop thus became very patchy ; as Statement No. IX will show 285-F was the worst affected. Later the crop was attacked by root-rot which did considerable damage to all the varieties.

The results (Statement No. I) speak for themselves and little more need be added. In reading these results footnote should always be considered and also the fact that the prices given in the statement are what were given for the samples by the local ginners, who conducted the ginning tests for us.

It may be added here that 40 Rosea which in all other respects is a very good desi type sheds the kapas from the bolls if not picked within a week. This is a drawback where labour is scarce and dear.

Wheats.—The types under test were :—

8-A
8-B
9-C
17-B
20-C
} Economic Botanist's selections.

Punjab 11 commonly grown in the colony and already distributed for seed and Pusa 12.

The plots were interstripped with 8-A as standard and the tests were repeated 5 times, but owing to the scarcity of labour at harvest they were harvested in two lots, 3 early sown plots in one lot and the two late sown ones in another lot. The results will be found in Statements Nos. 2 and 3.

Early sowings were done on comparatively poor soil while the land under late sowings was much richer and this difference in the soil had decided their early and late sowings. Crops sown early on rich lands are likely to lodge and those sown late on poor soils do not develop good grain.

Besides these two other wheats one of Mr. Howard's $NH_4 \times P_6$ and the other of Mr. Leak's C-13 were also tried on the farm and gave on an average 1,708 and 1,978 lbs. per acre, respectively. These are both beardless wheats with very good uniform grain and strong straw.

Early sowings were done on 25-27th October 1918 and the later on 29th November 1918. The sowing at different times was not done with any particular object, for early sowings do better as the crop gets longer ripening period, but this had to be done owing to canal closures. The results will show that 8-A which had done well last year has again topped the list in early sowings and is undoubtedly the type for future propagation and distribution. All its produce has been kept for distribution of seed for next Rabi.

In the late sowing as could be expected Pusa 12 has done well. It is an early ripening wheat and has, therefore, the great advantage of escaping the early hot winds of April which shrivel the grain so much and reduce the outturn. Another fact which is borne out by the experience of former years and other places is that given better conditions of soil, moisture and cultivation Pusa 12 does better than local types. But its beardless character is against it and it is never going to be popular in our colonies. 8-A in the late sowings had by an unfortunate chance some of the comparatively poor plots.

Minor Crops—Fodders, Oats and Jowars.

Fodders are as important in this colony as cereals and their cultivation demands more attention here than elsewhere, for—

1. The cultivators in this colony are generally Janglies who in spite of all the rise in prices of cotton and foodstuffs look upon cattle as a better and more important part of their assests, and

2. The colony is principally a horse-breeding colony and as such must grow good fodders. It is important, therefore, that a start should be made in this direction and attention will in future be devoted to finding fodder crops which can supply green fodder to cattle all the year round.

Oats.—Two varieties of oats were tested, local against French oats. The seed was very kindly supplied by Major Mayne of the Sargodha Remount Depôt who in fact suggested the experiment. The sowings were done on the 8th October 1918 and harvesting in the case of local seed was done on the 9th April 1919, while French oats were not ready for harvesting (for seed) till 6th May 1919, *i.e.*, were a month later.

A later sowing was also attempted on the 26th November 1918 and in this case the local type was cut on 2nd May 1919 and the foreign on the 22nd May 1919.

The outturn per acre was—

		Grain.		*Bhusa.*	
Local seed	...	31·79	maunds.	48·49	maunds per acre.
French seed	...	9·19	„	132·49	„ „

Major Mayne made similar tests on his farm, his results were—

		Grain.		*Bhusa.*	
Local seed	...	29·18	maunds	55·65	maunds
French oats	...	10·23	„	148·95	„

The growth in the case of French oats was very luxuriant giving good broad leaf and very bulky fodder. As a fodder crop the French seed is much superior.

It gives heavier cuttings and keeps green till the middle of May when no other green stuff is available, but they do not seem to come to seed in our climate ; perhaps the season is not long enough for them and I think to get good results, the seed will have to be imported every year. The seed when acclimatized may get to ripen earlier and this year's produce of grain will be tried next Rabi though I am not very hopeful of any good results.

Jowars.—These varieties of Jowar were brought by me from Central Provinces (Akola Farm) in 1917 ; and have been grown on this farm for the last two years. They are all three sweet varieties and much relished by animals and give far heavier crops of green fodder than any local type ; but they are very late in ripening and even in the beginning of December were quite green. This though an advantage from the fodder point of view, is a great drawback from that of grain, and if ever introduced their seeds must be obtained from the Central Provinces every year. Some seed has been obtained from the last crop which looks poor but shall be tried this year to see how it fares.

Other minor crops tried were rapes and grams.

Four different varieties of rape were tried, English, Japan, Jullundhuri and Ludhiana. The English seed germinated very late, but had a very luxuriant growth, it was, however, badly attacked by aphis and had to be destroyed. The outturn in the case of others was 732 lbs., 636·8 lbs. and, 589 lbs., respectively.

Four of Economic Botanist's selections of gram (Nos. 7, 15, 17 and 20) were tested against local seed but the germination and stand in all cases was bad and the test shall be repeated next Rabi.

Cultivation.—Spacing experiments, Statement No. 8.

Spacing experiments for American cotton were undertaken to find out the right distance between the rows. At present 3′ apart, *i.e.*, 3′ between the lines is recommended for American cottons. 3 acres were put under this experiment, 2 acres of very good land and an acre of comparatively poor. The distance between the rows was kept at 4′-2½″ and 3′-2½″. The results are in favour of wider spacing, and there can be no doubt that on rich soils it does give much better results. The correct distance for these cottons seems to be from 3′-5′ according to the richness of the soil.

Root-rot did considerable damage in these plots.

Water saving experiment—This experiment was started last year and its object was explained in the last report but it will be well to repeat it again here.

The experiment was started on the recommendation of Mr. Howard to find out the water requirements, or to put it better to prove that our wheat crops in the colonies do not require so much water as they are given and that this too much watering results not only in wastage of water, but reduces the outturn as well. It is true that in the colonies water is made to take the place of cultivation but if the latter were done properly, the water demand of our wheat crop would be much less. It, however, remains to be seen what would be done with the surplus water thus saved. The operations to be carried out as summed up by Mr. Howard himself are—

(*a*) The stubble should be broken up as early as possible to allow of complete absorption of monsoon rainfall. This must be conserved by surface cultivation with the spring-tine cultivator after each large fall.

(*b*) After the preliminary irrigation applied about November 10th, the surface must be cultivated by the spring-tine cultivator as soon as the ground is just dry enough followed by the beam. The land should be ploughed, the wheat sown in the furrows and covered in as soon as possible.

(*c*) All surface crusts formed by rain, dew and irrigation water should be broken at once with the lever harrow, the first harrowing being done as soon as the wheat is up. When the lever harrow can no longer be used, the Brant-Ford Weeder can be employed to break crusts.

(*d*) The 2nd irrigation should be given to half the plot about the end of January.

(*e*) The variety sown should be Pusa 12.

(*f*) The plot should be laid out in the long oblong kiaris with the proper slope ($1\frac{1}{2}$" to 2" per 100') in stopping water in the distributary, the canvas dam should be used.

The experiment is really very instructive. The results obtained during these two years clearly show that good cultivation and timely handling of the soil can do away with a greater part of the clamour for more water and the complaint against short supplies. In both the years no water plots have given from three to four hundred pounds of grain per acre more than the district average of canal irrigated lands. In these areas water generally takes the place of cultivation. This year's results are practically interesting, for the season from sowing time throughout the growth of the crop till harvest was very dry (see rainfall table) : withal no water plot this year gave 1,322 lbs. per acre against the colony average of 1,066 lbs. where the previous crop was cotton. The outturn where the previous crop was chari (sorghum) is much less than the above, and this shows the exhaustive nature of this crop. The results obtained in all the four plots one watering against no watering and one watering agaist two waterings uniformly bear this out that chari leaves the soil undoubtedly poor and this is why that wheat after chari is a very rare practice.

It is further very interesting to see that chari plot responded better to 2nd watering and that irrigation does not supply water only but has the incidental benefit of adding fertility too, even the water that seems quite pure may contain sufficient plant food in solution or in the mud that it carries to make it worth while to distribute this water on land solely for the sake of plant food that it contains, which is mostly left in the soil when the water evaporates or seeps down. But this should not be understood to mean that flooding helps all the crops. It, on the contrary, injures them by stopping aeration of roots unless the land is harrowed after irrigation to break crust. Next year the experiment shall be conducted on much larger scale with zamindars too and in the Remount Depôt; also as many as 3 and if possible 4 irrigations will also be tried.

It may be observed here that if this method of cultivation is adopted a wheat with a shorter ripening period like Pusa 12 is a great advantage, for the sowings must be pretty late.

Water saving experiment with Toria (Brassica Compestris) Statement No. 7.

This experiment is particularly interesting. It was suggested or rather forced upon us by the unusual canal 'bandis' last October which were delaying wheat sowings. This crop is usually given two waterings, but in the experiment under report one watering and no watering was tried. The results are beyond expectation and could not be more encouraging, especially when it is considered that season was exceptionally dry. One watering has given only $23\frac{5}{6}$ lbs. per acre more than purely barani (no watering) crop, and this 24 lbs. even with the present exceptionally high prices would not pay the cost of irrigation.

There are other far reaching results. Water at this time of the year is in great demand for both Toria and for sowing wheats, and any water that can be saved from Toria means more early sown wheat and consequently better return. The experiment shall be continued.

Tenants.—Tenants have 112 acres under them. They grow seeds for us and advertise and introduce our implements, methods of cultivation and seeds in the neighbourhood. Their desirability on such a farm was fully explained in last year's report. These trained men are very much in demand and get very favourable terms outside where there is interest and enthusiasm in the improvement of Agriculture.

Implements.—Raja plough, spring tined harrow, bullock hoe and lever harrow are the chief implements in use on the farm. Cheap Lyallpur harrows and Drills are also made on the farm for sale in the colony. During the year under report 38 of these were sold. These are very simple in construction and can be very easily copied by village carpenters from our original. Such implements are supplied on cost price.

Seed selection and distirbution work.—Seed selection work with wheat Punjab 11 and cotton 4-F is done on the farm and the produce is sold out for further multiplication and distribution as seed in the colony. During the year under report the farm was responsible for the distribution of more than 1,312,000 lbs. of wheat and 307,336 lbs. of cotton seed. We had arranged this year for 726,930 lbs. of cotton seed, but could not dispose of all the seed as the prices charged by the Department were very high almost about double the market rate, and secondly most of the growers had kept their own hand ginned seed. Further, besides our supply of wheat seed a good many of the zamindars keep their own seed under the Department's instructions.

Visitors.—The farm is now well-known and is much frequented by zamindars for implements, seeds and advice. During the year under report over 300 visitors visited the farm and were shown round and explained the work in progress.

Income and expenditure.—The total receipts from the sale of farm produce were Rs. 9,965-6-10 and the expenditure during the year came to Rs. 2,254-14-9.

Staff.—Q. Samiullah both as Farm Manager and District Assistant has done excellent work. He has the confidence of the zamindars of the District and deserves all credit for the good working of the farm and the expansion of the district work.

Acknowledgments.—Mr. B. T. Gibson, I.C.S., late Deputy Commissioner, Shahpur, took a great interest in the work on the farm and was always ready to help to bring the results obtained on the farm and the recommendations of the Department to the notice of the zamindars. His visits to the farm were a great encouragement. I wish also to acknowledge the interest and sympathy in our work shown by Major Mayne of the Sargodha Remount Depôt. He has vastly improved his own cultivation since he has come to Sargodha and there exists now a very healthy rivalry and competition between the two farms in the methods of cultivation and use of implements and production of crops. His cheerful disposition and interest in the improvement of Agriculture have brought both the places very close together.

GURDASPUR:
The 31st July 1919.

FATEH-UD-DIN,
Deputy Director of Agriculture,
1st Circle, Gurdaspur.

Statement No. I.

SHOWING THE OUTTURN OF DESI AND AMERICAN COTTON VARIETIES TESTED IN KHARIF 1918 AT THE SARGODHA SEED FARM.

No. of plot.	Name of variety.	Area sown in square yards.	Area destroyed by rot-rot in square yards.	Area harvested in square yards.	Actual outturn in lbs.	Outturn per acre on the area sown in lbs.	Outturn per acre on the area harvested in lbs.	Lint from a maund of kapas.	Price per maund according to lint percentage and kapas as well.	Actual price.	Price per acre on the area sown.	Price per acre on the area harvested.	Date of sowing.	Dates of picking.	Remarks.
								Sr. Ch.k.	Rs. A. P.	Rs. A P.	Rs. A. P.	Rs. A. P.			
A	Khanna ...	2,449·7	382·6	2,067·1	672·17	1,323·95	1,573·8	14 15	17 15 0	147 0 7	289 9 9	344 4 3	19-20th April 1918.	5th Septr. 1918, 12th September 1918, 18th September 1918, 28th September 1918 2nd October 1918, 7th October 1918, 12th October 1918, 18th October 1918, 26th October 1918, 6th November 1918, 15th November 1918, 24th November 1918, 5th December 1918, 14th December 1918, 24th December 1918, 4th January 1919, 14th January 1919.	The stubble broken with the Raja plough on 31st December 1918.
„	285-F. ...		432·1	2,017·6	220·88	436·4	529·8	12 8	17 10 0	47 7 7	93 12 9	113 12 6			S. T. Harrow 3 times on 11th January 1918, 16th March 1918, 10th April 1918.
„	22 Mollisonia ...		238	2,211·7	670·76	1,325·2	1,467 8	15 8	18 8 0	151 5 3	298 15 7	331 2 5			Sohagaing—3 times on 26th February 1918, and twice on 10th April 1918.
„	280-F. ...		367	2,082·7	437·16	863·7	1,015·9	12 10	17 12 6	94 12 9	187 4 7	220 4 8			Desi plough 2 times on 19th March 1918, and 14th April 1918.
„	40 Rosea ...		1,104·1	1,345·6	482·98	954·2	1,737·2	14 4	17 4 0	101 9 8	200 11 8	365 7 2			Horse hoe once on 28th March 1918.
„	4-F. ...		810·4	1,639·3	440·9	871·1	1,301·7	12 12	18 11 0	100 7 8	198 8 4	296 10 5			Bar harrow 2 times on 1st June 1918, 1st July 1918.
B.	Khanna ...		708·4	1,741·3	528·9	1,044·97	1,470·1	14 15	17 15 0	115 11 2	228 9 4	321 9 4			Lyallpur hoe once on 4th July 1918.
„	285-F. ...		819·8	1,629·9	224·47	443·49	666·56	12 9	17 10 0	48 3 11	95 5 2	143 4 4			Horse hoe once on 17th July 1918.
„	22 Mollisonia ...		171	2,278·7	575·15	1,136·36	1,221·62	15 8	18 8 0	129 12 2	256 6 0	275 9 9			Waterings after sowing 6 times on 29th May 1918, 14th July 1918, 9th August 1918, 6th September 1918, 19th September 1918, 4th October 1918.
„	280-F. ...		168 8	2,280·9	363·62	718·4	771·59	12 10	17 12 6	78 13 7	155 12 6	167 5 0			
„	40 Rosea ...		436·4	2,013·3	556·57	1,099·64	1,338·0	14 4	17 4 0	117 1 4	231 5 3	281 7 6			
„	4-F. ...		229·3	2,220·4	361·20	713·64	787·33	12 12	18 11 0	82 5 1	162 10 2	179 6 10			

Statement No. II.

SHOWING COMPARATIVE TEST OF DIFFERENT WHEAT TYPES TRIED AT THE SARGODHA SEED FARM DURING RABI 1918-19 (EARLY SOWINGS).

No. of plot.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
						Grain.	Bhusa.	Grain.	Bhusa.	
I. J. K.	Wheat ...	8-A ...	25th to 27th October 1918	27th to 28th April 1919	19,046⅓	7,790	18,542¼	1,979·57	4,711·9	The stubble broken with the Raja plough on 5th July 1918.
Do.	Do. ...	8-B ...	Ditto	Ditto	2,742⅔	963½	4,071⅗	1,700·29	7,184·64	S. T. Harrow 5 times on 8th July 1918, 24th August 1918, 9th September 1918, 27th September 1918 and 2nd October 1918.
Do.	Do. ...	9-C ...	Ditto	Ditto	2,742⅔	1,043⅘	4,177⅘	1,842	7,372·76	Desi plough 3 times on 24th July 1918, 20th September 1918, 14th October 1918.
Do.	Do. ...	11 ...	Ditto	Ditto	2,742⅔	1,061⅘	3,327⅛	1,873·94	5,871·47	Sohagaings 5 times on 1st September 1918, 4 times on 25th October 1918.
Do.	Do. ...	17-B ...	Ditto	Ditto	2,742⅔	859	4,057	1,515·88	7,159·41	Waterings 3 times to area I and J on 22nd December 1918, 4th February 1919 and 2nd March 1919.
Do.	Do. ...	20-C ...	Ditto	Ditto	2,742⅔	838½	3,823¼	1,479·71	6,746·91	2 waterings to area K on 22nd December 1918 and 4th February 1919.
Do.	Do. ...	Pusa 12 ...	Ditto	Ditto	2,742⅔	943	3,411½	1,669 11	6,019·76	Chain and Bar harrow 2 times on 17th November 1918 and 6th January 1919.

Statement No. III.

COMPARATIVE TEST OF DIFFERENT WHEAT TYPES TRIED AT THE SARGODHA SEED FARM DURING RABI 1918-19 (LATE SOWINGS).

No. of plot.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
						Grain.	Bhusa.	Grain.	Bhusa.	
G. and H.	Wheat	8-A	29th November 1918	28-29th April 1919	12,799$\frac{1}{9}$	4,711	13,501$\frac{3}{10}$	1,781·47	5,105·53	The stubble broken with the Raja plough on 16th June 1918. S. T. Horrow 7 times on 7th July 1918, 28th July 1918, 23rd August 1918, 10th September 1918, 27th September 1918, 1st October 1918 and 24th November 1918.
Ditto	Do.	8-B	Ditto	25th April 1919	1,828$\frac{4}{9}$	647$\frac{1}{5}$	1,968	1,714·76	5209·41	
Ditto	Do.	9-C	Ditto	Ditto	1,828$\frac{4}{9}$	645$\frac{3}{4}$	1,681	1,709·39	4,449·7	Desi plough 4 times on 12th August 1918, 16th September 1913, 15th October 1918 and 25th November 1918.
Ditto	Do.	11	Ditto	26th April 1919	1,828$\frac{4}{9}$	504$\frac{1}{2}$	1,170$\frac{5}{8}$	1,336·1	3,098·65	Sohagaings 4 times. Once on 1st September 1918 and 3 times on 24th November 1918.
Ditto	Do.	17-B	Ditto	25th April 1919	1,828$\frac{4}{9}$	639$\frac{3}{8}$	1,689$\frac{1}{2}$	1,693·05	4,471·41	Waterings 3 times. Area H on 3rd January 1919, 19th February 1919 and 14th March 1919 and area G. on 4th February 1919, 2nd March 1919 and 30th March 1919.
Ditto	Do.	20-C	Ditto	Ditto	1,828$\frac{4}{9}$	749$\frac{1}{4}$	2,161$\frac{3}{4}$	1,983·3	5,722·27	Bar harrow 2 times on 18th December 1918 and 12th January 1919. Three plots of 8 A., were on comparatively poor soil in this test.
Ditto	Do.	Pusa 12	Ditto	Ditto	1,828$\frac{4}{9}$	870$\frac{1}{8}$	1,528$\frac{1}{2}$	2,303·47	4,045·35	

Statement No. IV.

COMPARATIVE TESTS OF SARGODHA DEPOTS AND FRENCH OATS TRIED AT THE SARGODHA SEED FARM DURING RABI 1918-19.

No. of plot.	Previous crop.	Name of crop sown.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
						Grain.	Bhusa.	Grain.	Bhusa.	
C. ...	Cotton ...	French oats ...	8th October 1918	6th May 1919 ...	2,150⅔	335½	4,827¾	754·35	10,864·68	The stubble broken with the Raja plough on 5th January 1918. S. T. Harrow 5 times on 6th January 1918, 9th June 1918, 7th September 1918, 30th September 1918, 3rd October 1918.
Odd corner	Cotton ...	French oats ...	26th Novr. 1918	22nd May 1919	431	24⅔	420½	276·25	4, 719·28	Desi plough once on 13th September 1918.
										No. of waterings with dates to Sargodha Depôt oats
C. ...	Cotton ...	Sargodha Depôt oats.	8th October 1918	9th April 1919	2,595	1,398	2,132	2,607·44	3,976·44	*Area C*—4 times on 12th November 1918, 22nd December 1918, 4th February 1919, 2nd March 1919.
Odd corner.	Cotton ...	Sargodha Depôt oats.	26th Novr. 1918	2nd May 1919 ...	335	61½	274½	888·53	3,969·52	*Area odd corner*.— 2 times on 4th February 1919, 14th March 1919.
										No of waterings with dates to French oats.
										Area C—3 times on 4th February 1919, 2nd March 1919, 14th March 1919.
										Area odd corner :—2 times on 4th February 1919, 14th March 1919.
										Bar Harrow 2 times to Sargodha Depôt oats and once to French oats.

Statement No. V.

WATER SAVING EXPERIMENT WITH WHEAT DURING RABI 1918-19.

No watering versus *one watering after sowing.*

No. of plot.	Previous crop.	Name of variety sown.	Date of sowing.	Date of harvesting	No. of watering after sowing.	Actual area in square yards.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
							Grain.	Bhusa.	Grain.	Bhusa.	
E	Cotton ...	Pusa 12 ...	28th Novr. 1918	10th April 1919	No watering after sowing	3,500	956½	1459½	1,362·47	2,018·28	The stubble broken with the Raja plough on 17th January 1918. S. T. Harrow 10 times on 7th February 1918, 19th June 1918, 27th July 1918, 2nd August 1918, 14th August 1918, 7th September 1918, 19th September 1918, 29th September 1918, 10th October 1918, and 10th November 1918.
E	Chari ...	Pusa 12 ...	Ditto	Ditto	Ditto	2,200	248	379½	545·6	1,934·9	
E	Cotton ...	Pusa 12 ...	Ditto	Ditto	One watering.	3,500	1,233	3,412	1,705·66	4,718·28	Desi plough 2 times on 20th November 1918 and 22nd November 1918, Sohagaings 6 times on 20th November 1918 and 22nd November 1918. Hoeing with Chain and Bar harrows 4 times on 18th December 1918, 9th January 1919, 2nd February 1919, and 13th February 1919.
E	Chari ...	Pusa 12 ...	Ditto	Ditto	Ditto	2,200	415½	923½	914·1	2,031·7	*Hoeing* with Brant Ford weeder once on 10th March 1919.

Statement No. VI.

WATER SAVING EXPERIMENT WITH WHEAT DURING RABI 1918-19.

One watering versus *two waterings after sowing.*

No. of plot.	Previous crop.	Name of variety sown.	Date of sowing.	Date of harvesting.	No. of waterings after sowing.	Actual area in square yards.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
							Grain.	Bhusa.	Grain.	Bhusa.	
F	Cotton ...	Pusa 12 ...	28th November 1918.	17th April 1919.	1	3,500	1,331½	3,198	1,841·27	4,422·37	The stubble broken with the Raja plough on 17th January 1918. S. T. Harrow 10 times on 7th February 1918, 19th June 1918, 27th July 1918, 2nd August 1918, 14th August 1918, 7th September 1918, 19th September 1918, 29th September 1918, 10th October 1918, 10th November 1918. Desi plough, 2 times on 20th November 1918, 22nd November 1918. Sohagaings 6 times on 20th November 1918, 22nd November 1918. Hoeings withschain and Bar harrows 4 times on 18th December 1918, 9th January 1919, 2nd February 1919, 13th February 1919. Hoeing with Brant Ford weeder once on 10th July 1919.
F	Chari ...	Do.	Do.	Do.	1	2,200	303½	762⅖	667·7	1,677·72	
F	Cotton ...	Do.	Do.	Do.	2	3,500	1,385⅕	3,964⅘	1,916·36	5,482·68	
F	Chari ...	Do.	Do.	Do	2	2,200	401⅘	1,326⅖	883·96	2,918·68	

Statement No. VII.

WATER SAVING EXPERIMENT WITH THE TORIA CROP TRIED IN RABI 1918-19, AT THE SARGODHA SEED FARM.

No. of plot.	Previous crop.	Name of crop sown.	Date of sowing.	Date of harvesting.	No. of waterings after sowing.	Actual area in square yards.	Actual outturn in lbs.	Outturn per acre in lbs.	Remarks.
							Grain.	Grain.	
L, M. N.	Wheat ...	Toria ...	8th September 1918.	10th January 1919.	One watering after sowing.	13,804	2,439½	855·34	The stubble broken with the Raja plough on 30th July 1918. S. T. Harrow 4 times on 1st August 1918, 26th August 1918, 8th September 1918 and 9th September 1918. Desi plough 2 times on 8th August 1918 and 19th September 1918. Sohagaings 2 times on 8th September 1918 and 9th September 1918.
M. N.	Do. ...	Do. ...	Do. ...	Do. ...	No watering	11,956⅔	2,054 1/10	831·48	

Statement No. VIII.

STATEMENT SHOWING RESULTS OF SPACING EXPERIMENTS WITH 4-F AMERICAN COTTON TRIED AT THE SARGODHA SEED FARM IN KHARIF 1918.

No. of plot.	Name of variety.	Distance at which sown.	Area sown in square yards.	Area destroyed by root-rot in square yards.	Area harvested in square yards.	Actual outturn in lbs.	Outturn per acre on the area sown in lbs.	Outturn per acre on the area harvested in lbs.	Lint from a maund of kapas.	Price per maund, according to lint percentage and the kapas as well.	Actual price.	Price per acre on the area sown.	Price per acre on the area harvested.	Date of sowing.	Date of picking.	Remarks.
									Srs. Ch.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.			
C	4-F American Cotton.	4′—2½″	4,905·5	986·2	3,919·3	749·27	739·2	925·2	12 12	18 11 0	170 12 1	168 7 4	210 13 7	20th April 1918	10th October 1918, 24th October 1918, 2nd Novr. 1918, 14th Novr. 1918, 24th Novr. 1918, 5th Decr. 1918, 14th Decr. 1918, 24th Decr. 1918, 14th Jany. 1919, 27th Jany. 1919.	The stubble broken with the Raja plough on 6th February 1918, S. T. Harrow 3 times on 7th February 1918, 11th March 1918, and 12th April 1918. Desi plough 3 times on 14th February 1918, 22nd March 1918 and 12th April 1918. *Sohagaings*:— 6 times once on 27th February 1918, twice on 12th April 1918, and thrice on 15th April 1918. Horse hoe once on 28th March 1918, Waterings— 5 times on 13th June 1918, 1st July 1918, 14th July 1918, 22nd August 1918 and 6th September 1918. Horse hoe once on 17th July 1918. Bar harrow 2 times on 15th June 1918. Lyallpur hoe once on 4th July 1918.
C	Ditto	3′—2½″	4,905·5	575·2	4,330·3	623·20	614·8	696·55	12 12	18 11 0	142 0 5	140 1 9	158 11 10	Ditto		
L	Ditto	4′—2½″	2,350	362·6	1,987·4	370·28	762·6	901·7	12 12	18 11 0	84 6 2	173 10 10	205 7 11	Ditto	14th December 1918 24th Decr. 1918, 14th Jany. 1919, 27th January 1919.	
D	Ditto	3′—2½″	2,350	362·6	1,987·4	371·26	764·6	904·1	12 12	18 11 0	84 9 9	174 4 0	206 0 8	Ditto	14th Decr. 1918, 24th Decr. 1918, 14th January 1919, 27th January 1919.	

Statement No. IX showing the area destroyed by root-rot, etc., in the Sargodha Seed Farm experimental plots A and B. The spots yellow coloured are destroyed by root-rot, etc.

Scale of length 100=1"
" " Breadth 20=1"
Patches destroyed Root Rot = Yellow

PLOT A.

4-8"=96'

Khanna 16' | 285 F 16' | 22 Mollisoni 16' | 280 F 16' | 40 Rosea 16' | 4 F 16'

13-75" = 1378 feet.

16' 16' 16' 16' 16' 16'

City Side

PLOT B.

4-8"=96'

Khanna 16' | 285 F 16' | 22 Mollisoni 16' | 280 F 16' | 40 Rosea 16' | 4 F 16'

Western Circle

Fateh-ud-din,
Dated 20-8-19.

S.G.E.P.

Experiments at the Hansi Agricultural Station by Sardar Darshan Singh, Deputy Director of Agriculture.

Introductory.—The farm is now 5 years' old, and this is the 4th year of our regular experimental work. I have been in charge since the start of the farm, and am glad to say that it has passed the initial stages of its development.

The area under our control is a little over 100 acres and the gross income was Rs. 11,724-2-2. The average yield of wheat (irrigated) at the farm was 27 maunds 24¾ seers, as compared with 12 maunds 7 seers 12 chataks the average yield of the irrigated wheat in the district, while in certain cases our yield has been as high as 38½ maunds. Similarly the average yield of cotton (irrigated) in the district is 4 maunds 38 seers 15 chataks while the average yield at the farm is 9½ maunds, and in certain cases we had a yield of over 16 maunds per acre.

Season and its effects.—The total rainfall during the year under report was 11·33 inches (*vide* statement No. 1) as compared with 36·07 inches of the last year, and 15·24 the average rainfall of the district. The rain, like the last year, was very unevenly distributed, and during the month of August, we received as much as 8·31 inches, while we had only 3·02 during the rest of the eleven months. The season was very unfavourable for the barani crops, both rabi and kharif, which almost entirely failed. The light showers in June and July were by no means sufficient for kharif sowings, while the rabi sowing season was altogether rainless.

The 'nahri' crops were very good, and the supply of water in the canals was sufficient. There were heavy winds in March which caused the lodging of wheats to a certain extent, but this did not result in lowering the yield to any considerable extent, though it presented some difficulty in harvesting. Frost set in comparatively earlier and killed cotton bolls, affected the yield of rape and deteriorated the quality of gur during the latter part.

The light showers of rain received in January were very welcome for the wheat crop.

Cottons.—About 40 acres of cotton were grown at the farm under the various experiments including the experiment of Economic Botanist and the Parasite breeding plot.

The experiments carried out are as follows :—

Series No. 1, Varietal Test.—Four different varieties of American cotton, *i.e.*, 280-F, 275-F, 161-A F, 4-F and 8 of Desi (country) cottons, *i.e.*, Neglectum White Flowered Bhatla Selection, Neglectum Yellow Flowered Bh. S., Indicum White Flowered Bh. S., Indicum Yellow Flowered Bh. S., Local Bhatla, Mollisonia 24, Rosea 132, Rosea 87, and also Combodia cotton were tried against Indicum 135-A.

Among the Desis White Flowered Neglectum Bh. S. has given the highest yield per acre, *i e.*, 8 maunds 8 seers 13 chataks (the average yield) and in one plot it has yielded up to 16½ maunds, while among the Americans 161-A F stands at top yielding 12 maunds 13 seers 14 chataks.

Only White Flowered Neglectum Bh. S. has given an increase of 5 maunds 9 seers 12 chataks from standard per acre, and 161-A F an increase of 3 maunds 3 seers 11 chataks and all the rest have given under two maunds.

The results of the past years have also shown that Neglectum White Flowered Bh. S. is the best among the Desi cottons. (For full details please see statement Nos. 2 and 3.)

Plant to Plant selection of Desi Cottons.—The work is being carried on on the same lines as in previous years. The White Flowered Indicum Bh. S. has already gained great popularity and we expect to be able to sow very large area with this selection. The results of valuation show that it is by far the most profitable among the Desi cottons, and competes in profits per acre with the best of Americans. One of the main objects of this farm was to produce a good Desi variety of cotton and I am glad that this end is being achieved.

(Please see statement No. 4.)

SERIES No. 2.

Spacing experiments.—These were tried with (No. 1) 4-F American cotton and (No. 2) White Flowered Indicum Bh. S. The spacings were same as in previous years, *i.e.* 4, 3½, 3, and 2½ feet for Americans and 2½, 2, 1½ feet for Desis, the experiment was in duplicate. Three feet spacing has done best in case of American, and 2½ feet in case of Desi. Average yields per acre in case of American are—

Feet.	Mds.	srs.	chks.
4	11	0	4
3½	12	11	0
3	12	37	9
2½	12	14	0

(Statements No. 5 *a* and *b*.)

SERIES No. 3.

(*a*) Broad-casting *versus* sowing in lines.

(*b*) Different number of hoeings in broad-casted cotton.

(*c*) Same number of hoeings to cotton in lines but with different kinds of hoes.

These were tried in fields No. 1 to 7 of Block D. These are very uneven owing to big patches of Kallar and though great care and trouble was taken in deducting area of Kallar patches still the results are not reliable as the plants growing in these patches vary in size and yield according to the intensity of Kallar in the patches (statement No. 6 *a to c*).

SERIES No. 4.

Deep and Shallow ploughing as preparation for cotton sowing.—Deep ploughing tends to increase the yield of cotton. The highest yield was in plot prepared with Sabul Plough. (Please see statement No. 7.)

Experiment with early and late sown American and Desi Cotton.—The object of the experiment is to see the comparative effect on yield of Desi and American cotton when sown late, and to find out whether increased seed rate can counterbalance the effect of lateness to any extent.

The results are interesting as the late sown American has done better than the late sown Desi, but this requires confirmation yet—

STATEMENT No. 8.

	4-*F.*			*White Flowered. Neglectum Bh. S.*		
	Mds.	srs.	chks.	Mds.	srs.	chks.
Early sown in middle April ...	8	33	6	9	9	14
Late sown in middle May seed rate 6 seers per acre.	8	21	0	7	9	4
Late sown in middle May seed rate 10 seers per acre.	7	9	4	7	3	0

Manurial Experiment with Cotton (Use of Cotton sticks).—The object of the experiment is to make manurial use of cotton sticks instead of their remaining in land after the crop is over—

(*a*) Burning of cotton sticks and applying ashes.

(*b*) Removing and rotting cotton sticks and applying organic matter.

(*c*) Removing cotton sticks after last picking.

(*d*) Leaving cotton sticks for long time and removing before sowing.

The results are encouraging as addition of organic matter as well as ashes have resulted in an increase of yield. (Please see statement No. 9.)

(2) 10 lbs. of Nitrogen per acre in the form of Sodium Nitrate and Potassium Nitrate are being applied in conjunction with Farm yard manure. The land being uneven, the results are not reliable.

An experiment to find out how far hoeings can save waterings was conducted on three varieties of cotton.

Five hoeings and 1 watering, 4 hoeings and 2 waterings and so on up to 1 hoeing and 5 waterings. Three hoeings and 3 waterings seem to be quite suitable. (Please see statement No. 10.)

Permanent Cotton Plot.—An experiment to see how far growing cotton after cotton, on the same land every year affects its fertility was started in 1915. The results are as follows :—

1915			1916			1917			1918.		
Mds.	srs.	chks.	Mds.	srs.	chks.	Mds.	srs.	chks.	Mds.	srs.	chks.
11	22	10	19	9	0	1	13	0 (Crop destroyed by excessive rains.)	7	26	9

Miscellaneous.—Environment experiments were carried out for Economic Botanist, and Parasite breeding plot was kept for Assistant Professor of Entomology.

Wheats.—There are 18½ acres of irrigated wheat, no barani wheat could be sown on account of lack of rain at the proper time.

Varietal Test of Wheat.—Eight varieties of wheat, *i.e.*, 8-A, 8-B, Punjab 11, Punjab 17, 9-C, 17-B, 20-C and Pusa 12 were tried against Punjab 14.

The varieties were sown in duplicate. The average yields per acre are as follows in order of outturn. (Please see statement No. 11) :—

Name of Variety.	Average yield per acre.	Average yield per acre in terms of standard.	Increase or decrease as compared with standard.
	Mds. srs. chks.	Mds. srs. chks.	Mds. srs. chks.
8-A	38 18 15	33 11 6	5 6 15 Increase.
Punjab 11	34 33 2	33 4 14	1 28 4 Ditto.
Punjab 14	32 33 10	32 33 10	...
9-C	34 9 5	34 10 6	0 1 1 Decrease.
Punjab 17	31 35 1	32 1 14	0 6 13 Ditto.
17-B	30 26 5	32 38 6	2 12 1 Ditto.
20-C	30 13 5	32 36 8	2 22 14 Ditto.
8-B	29 5 10	33 37 6	4 31 12 Ditto.
Pusa 12	23 3 0	31 23 2	8 20 2 Ditto.

Deep and Shallow cultivation for Wheat.—Sabul, Rajah and Country ploughs were used in one acre plot each. Deep ploughing resulted in the increase of yield of both grain and bhusa as in previous years—

	Mds.	srs.	chks.
Sabul	25	29	0
Rajah	22	34	0
Country	22	20	0

(Please see statement No. 12.)

Sowings of Wheat by various methods.—Wheat 8-A was sown with Akola drill Lyallpur drill, Poona drill, New drill (prepared by Deputy Director of Agriculture), Shallow nali with Sohaga, Country method with Sohaga, and country method. The object of the experiment is to get good germination and a level surface for interculture and reaping. Observations were made at the time of germination. Shallow nali with Sohaga, Akola drill and the New draill have done best. But the New drill prepared at Hansi is by far the most economical. The Akola drill requires 4 men for sowing three furrows, while the Hansi drill sows 4 to 5 furrows with one man and one pair of bullocks.

Interculture Experiment with Wheat.—Wheat was intercultured with Chain Harrow, Lever Harrow and Bar Harrow. Harrowing wheat has increased the yield in two out of three cases.

Wheat after Wheat Experiment.—Wheat after wheat is shown in the same plot to see how far it affects the fertility of the soil—

Year 1916-17.	*Year* 1917-18.	*Year* 1918-19.
Mds. srs. chks.	Mds. srs. chks.	Mds. srs. chks.
30 20 0	22 20 0	19 10 0

Sugarcane.—Three acres of sugarcane were grown under the same varieties as last year These were sown in duplicate and 15 tons of farm yard-manure per acre was applied (Statement No. 13.) Bihar, a new variety, was also tried on a small strip and promises to do well. This will be given a trial next year.

Barley and Gram.—Four varieties of barley obtained last year from the Economic Botanist, Punjab, were grown again this year. Type No. 2 has given the highest yield of 30 maunds per acre. (Statement No. 14 *a*.)

Three gram varieties were obtained last year from Burma and tried again this year. Local grams have however done best. Though Burma No. 1 (white) and Black Burma are promising and have done better than last year. (Statement No. 14 *b*.)

Mustard—Brown and Yellow varieties of Mustard were received from Graham & Co., Calcutta, and were given a trial against local variety and rape. Both the varieties received from Graham & Co. have yielded poorly and the seed also deteriorated in size and colour. (Statement No. 15.)

Miscellaneous.—Jowar, Bajra, Japan rape, Gowar, Oats, Beetroot were also grown at the farm.

Silage.—About 1,000 maunds of green fodder was again ensilaged in August 1918 and green fodder was available in March and April, when it was much needed.

Visitors.—His Honour the Lieutenant-Governor, Punjab, paid a visit to the farm in January; Commissioner, Ambala Division, Deputy Commissioner, Hissar, Mr. Darling, Assistant Registrar, Co-operative Society, and Executive Engineers and Sub-Divisional Officers of Canals and many other officers and leading zemindars including a party of Revenue Officers and members of District Board and zemindars of Hissar District paid a visit to the farm during the year under report.

DARSHAN SINGH,

Deputy Director of Agriculture.

Statement No. 1.

SHOWING THE RAINFALL DURING THE YEARS 1917-18 AND 1918-19 ON THE HANSI AGRICULTURAL STATION.

Name of month.	Rainfall during 1917-18.	Rainfall during 1918-19.	Remarks.
1	2	3	4
June	3·23	0·12	
July	2·73	1·26	
August	4·93	8·31	
September	15·31	0·12	
October	7·61	*Nil*	
November	*Nil*	*Nil*	
December	0·09	*Nil*	
January	0·45	0·95	
February	0·05	0 20	
March	1·59	0·04	
April	0·08	0·17	
May	*Nil*	0·16	
Total ...	36·07	11·33	

STATEMENT No. 2.

Statement No. 2.

SHOWING THE RESULTS OF VARIETAL TESTS OF COTTON EXPERIMENT GROWN AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1918.

Block and plot.	Name of variety.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Outturn per acre in term of standard. Maunds.	Outturn per acre in term of standard. Seers.	Outturn per acre in term of standard. Chataks.	Remarks.
C / 14 *a*	Indicum 135-A	59 / 240	8,308 / 43,560	10th April 1918 ...	19th August 1918 ...	11th January 1919 ...	1	20	8	7	37	3	7	37	3	
C / 14 *b*	Cambodia Cotton	Do.	59 / 240	Ditto ...	20th December 1918	3rd February 1919 ...	0	9	11	0	39	6	8	38	12	
C / 15 *a*	Indicum 135-A	Do.	10,372 / 43,560	Ditto ...	19th August 1918 ...	11th January 1919 ...	2	15	6	10	0	8	10	0	8	
C / 15 *b*	161-A. F.	Do.	10,136 / 43,560	Ditto ...	15th October 1918 ...	Ditto ...	2	10	2	9	27	5	9	15	14	Sohagaings ... 4
C / 16 *a*	Indicum 135-A	Do.	7,518 / 43,560	Ditto ...	17th August 1918 ...	Ditto ...	1	20	10	8	31	4	8	31	4	Harrowings ... 5
C / 16 *b*	2.5-F.	Do.	8,236 / 43,560	Ditto ...	15th October 1918 ...	Ditto ...	1	16	12	7	20	2	7	22	14	Sohagaings ... 9
C / 17 *a*	Indicum 135-A	Do.	7,818 / 43,560	Ditto ...	17th August 1918 ...	Ditto ...	1	5	11	6	14	8	6	14	8	Hoeings ... 4
C / 17 *b*	280-F.	Do.	6,458 / 43,560	Ditto ...	15th October 1918 ...	Ditto ...	1	6	7	7	33	3	6	34	15½	Waterings ... 5
C / 18 *a*	Indicum 135-A	Do.	9,556 / 43,560	Ditto ...	17th August 1918 ...	Ditto ...	1	24	13	7	15	7	7	15	7	
C / 18 *b*	4.-F.	Do.	8,452 / 43,560	Ditto ...	15th October 1918 ...	Ditto ...	1	9	15	6	17	5	7	21	0	
C / 19 *a*	Indicum 135-A	Do.	59 / 240	Ditto ...	14th August 1918 ...	Ditto ...	1	35	6	7	26	9	7	26	9	

C / 19 *b*	Mollisonea 24	Do	Do.	Ditto ...	Ditto ...	Ditto ...	1	32	0	7	12	14	6	18	12
C / 20 *a*	Indicum 135-A	Do.	9,008 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	3	10	5	10	15	5	10	15
C / 20 *b*	Rosea 87	Do.	9,552 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	5	0	5	5	3	5	22	12
C / 21 *a*	Indicum 135-A	Do.	10,400 / 43560	Ditto ...	Ditto ...	Ditto ...	1	16	0	5	34	9	5	34	9
C / 21 *b*	Rosea 132...	Do.	9,308 / 43,560	Ditto ...	Ditto ..	Ditto ...	1	26	5	7	30	5	6	18	14
C / 22 *a*	Indicum 135-A	Do.	59 / 240	Ditto ...	Ditto ...	Ditto ...	1	29	10	7	3	3	7	3	3
C / 22 *b*	Local Bhatla	Do.	Do.	Ditto ..	Ditto ...	Ditto ...	1	20	9	6	3	5	7	32	7
C / 23 *a*	Indicum 135-A	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	2	4	0	8	21	11	8	21	11
C / 23 *b*	Yellow flowered Indicum Bhatla S.	Do.	10,228 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	24	13	6	36	0	7	21	0
C / 24 *a*	Indicum 135-A ...	Do.	59 / 240	Ditto ...	Ditto ...	Ditto ...	1	24	0	6	20	5	6	20	5
C / 24 *b*	Yellow flowered Neglectum Bhatla S.	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	1	27	6	6	34	0	5	35	4½
C / 25 *a*	Indicum 133-A ...	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	1	11	11	5	10	4	5	10	4
C / 25 *b*	White flowered Indicum Bhatla S....	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	1	26	4	6	29	7	5	30	9½
C / 26 *a*	White flowered Neglectum Bhatla S.	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	2	18	13	10	1	15	5	30	9½
C / 26 *b*	Indicum 135-A ...	Do.	9,308 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	13	10	6	10	5	6	10	15

Statement No. 2—*concluded.*

STATEMENT SHOWING THE RESULTS OF VARIETAL TESTS OF COTTON EXPERIMENT GROWN AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1918—CONCLUDED.

Block and plot.	Name of variety.	Area sown in acres.	Area harvested in acre.	Date of Sowing.	Date of 1st picking.	Date of Last picking.	Actual outturn Maunds.	Actual outturn Seers.	Actual outturn Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Outturn per acre in term of standard. Maunds.	Outturn per acre in term of standard. Seers.	Outturn per acre in term of standard. Chataks.	Remarks.
C / 14 *c*	Indicum 135-A ...	59 / 240	8,608 / 43,560	10th April 1918 ...	21st August 1918 ...	11th January 1919 ...	1	30	12	8	38	0	8	38	0	
C / 14 *d*	White flowered Neglectum Bhatla S.	Do.	9,804 / 43,560	Ditto	Ditto ...	Ditto ...	3	28	13	16	14	8	10	6	4½	
C / 15 *c*	Indicum 135-A ...	Do.	59 / 240	Ditto ...	Ditto ...	Ditto ...	2	31	12	11	14	9	11	14	9	
C / 15 *d*	White flowered Indicum Bhatla S....	Do.	9,812 / 43,560	Ditto ...	Ditto ...	Ditto ...	2	29	7	13	6	6	9	3	0	
C / 16 *c*	Indicum 135-A ...	Do.	9,908 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	21	12	6	31	7	6	31	7	
C / 16 *d*	Yellow flowered Neglectum Bhatla S.	Do.	9,178 / 43,560	Ditto ...	Ditto ...	Ditto ...	2	0	9	9	22	5	7	31	8½	
C / 17 *c*	Indicum 135-A ...	Do.	59 / 240	Ditto ...	Ditto ...	Ditto ...	2	6	7	8	31	10	8	31	10	
C / 17 *d*	Yellow flowered Indicum Bhatla S.	Do	Do.	Ditto ...	Ditto ...	Ditto ...	2	15	15	9	30	4	9	22	12½	
C / 18 *c*	Indicum 135-A ...	Do.	10,240 / 43,560	Ditto ...	Ditto ...	Ditto ...	2	17	5	10	13	15	10	13	15	
C / 18 *d*	Local Bhatla ...	Do.	9,688 / 43,560	Ditto ...	Ditto ...	Ditto ...	2	3	8	9	15	7	10	16	7	
C / 19 *c*	Indicum 135-A ...	Do.	10,468 / 43,560	Ditto ...	17th August 1918 ...	Ditto ...	2	20	11	10	18	15	10	18	15	

C / 19 *d*	Rosea 132	Do.	7,716 / 43,560	Ditto ...	Ditto .	Ditto ...	1	20	12	8	22	15	8	28	15½					
C / 20 *c*	Indicum 135-A	Do.	9,620 / 43,560	Ditto ..	Ditto ...	Ditto ...	1	21	10	6	39	0	6	39	0					
C / 20 *d*	Rosea 87	Do.	9,833 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	32	9	3	24	4	6	19	3					
C / 21 *c*	Indicum 135-A	Do.	9051 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	9	12	5	39	6	5	39	6					
C / 21 *d*	Mollisonea 24	Do.	59 / 240	Ditto ...	Ditto ...	Ditto ...	1	35	6	7	26	9	6	6	12½					
C / 22 *c*	Indicum 135-A	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	1	22	8	6	14	3	6	14	3					
C / 22 *d*	4-F.	Do.	Do.	Ditto .	15th October 1918 .	Ditto ...	1	30	8	7	39	5	6	23	7½					
C / 23 *c*	Indicum 135-A	Do.	Do.	Ditto ...	17th August 1918 ..	Ditto ..	1	27	1	6	32	12	6	32	12					
C / 23 *d*	280-F	Do.	Do.	Ditto ..	15th October 1918	Ditto ..	2	34	10	11	26	4	8	39	9½					
C / 24 *c*	Indicum 135-A	Do.	Do.	Ditto ..	17th August 1918 ..	Ditto ...	2	29	12	11	6	7	11	6	7					
C / 24 *d*	275-F	Do.	Do.	Ditto ...	15th October 1918...	Ditto ...	1	30	7	7	6	8	10	0	6½					
C / 25 *c*	Indicum 135-A	Do.	Do.	Ditto ...	17th August 1918 ...	Ditto ...	2	7	2	8	34	6	8	34	6					
C / 25 *d*	161-A F	Do.	Do.	Ditto ...	15th October 1918...	Ditto ...	3	27	10	15	0	7	9	4	9					
C / 26 *c*	Cambodia Cotton	Do.	Do.	Ditto ...	20th December 1918	Ditto ...	0	14	0	1	16	14	9	4	9					
C / 26 *d*	Indicum 135-A	Do	7,736 / 43,560	Ditto ...	17th August 1918 ...	Ditto ...	1	26	9	9	14	12	9	14	12					

Statement No 3.

CONSOLIDATED STATEMENT OF VARIETAL TESTS OF COTTON.

Serial No.	Name of variety.	Average yield per acre.	Average yield of Standard per acre.	Increase or decrease per acre as compared with Standard.	REMARKS.
		Mds. Srs. Ch.	Mds. Srs. Ch.	Mds. Srs. Ch.	
1	White flowered- Neglectum Bh. S.	13 8 3	7 38 10	5 9 12	Increase.
2	161-A. F. ...	12 13 14	9 10 3	3 3 11	,,
3	White flowered Indicum Bh. S.	9 17 14	7 16 13	2 1 1	,,
4	280-F. ...	9 29 11	7 37 5	1 32 6	,,
5	Neglectum Yellow flowered Bh. S.	8 8 2	6 37 7	1 10 11	,,
6	Mollisonea 24 ...	7 19 11	6 12 12	1 6 15	,,
7	Rosea 132 ...	8 6 10	7 23 15	0 22 11	,,
8	4-F. ...	7 8 5	7 2 4	0 6 1	,,
9	Indicum yellow flowered Bh. S.	8 13 2	8 21 14	0 8 12	Decrease.
10	Local Bhatla ...	7 30 14	9 4 7	1 13 9	,,
11	275-F. ...	7 13 5	8 31 10	1 18 5	,,
12	Rosea 87 ...	4 14 11	6 1 0	1 26 5	,,
13	Cambodia Cotton ...	1 8 2	9 1 10	7 33 8	,,
14	Indicum 135-A ...	7 35 10	7 35 10	...	,,

Statement No. 4.

SHOWING THE VALUATION OF LINT OF COTTON VARIETIES PER ACRE GROWN AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1918 AS VALUED BY THE KARACHI CHAMBER OF COMMERCE.

Serial No.	Name of variety.	Weight of cotton (Kappa) per acre.	Weight of lint per acre.	Percentage of lint to cotton.	Value of lint per maund.	Net amount.	REMARKS.
		Mds. Srs. Cls.	Mds. Srs. Cbs.		Rs. A. P.	Rs. A. P.	
1	Neglectum white flowered Bh. S. ...	13 8 3	4 31 3	36·2	41 4 0	197 2 7	
2	Indicum white flowered Bh. S. ...	9 17 14	3 6 9	33·5	41 8 0	131 4 11	
3	Neglectum yellow flowered Bh. S.	8 8 2	2 26 10	32·5	41 8 0	110 9 11	
4	Indicum yellow flowered Bh. S. ...	8 13 2	2 37 9	35·3	40 0 0	117 9 0	
5	Local Bhatla ...	7 30 14	2 22 9	33·01	41 8 0	106 6 6	
6	Mollisonea 24 ...	7 19 11	2 35 10	38·6	41 8 0	119 15 4	
7	Rosea 132 ...	8 6 10	3 5 9	37·5	40 0 0	125 9 0	
8	Rosea 87 ...	4 14 11	1 24 15	37·2	42 0 0	68 2 11	
9	161-A. F. ...	12 13 14	3 33 9	31·1	51 8 0	197 11 4	
10	280-F. ...	9 29 11	2 27 15	27·7	53 8 0	144 5 10	
11	275-F. ...	7 13 5	2 12 1	31·4	51 8 0	118 8 5	
12	4-F. ...	7 8 5	2 12 8	32·1	49 8 0	114 7 6	
13	Cambodia ...	1 8 2	0 16 0	33·3	46 8 0	18 9 7	

Statement No. 5 *a*.

SHOWING THE RESULTS OF SPACING EXPERIMENT WITH 4-F COTTON DURING KHARIF 1918 GROWN AT THE HANSI AGRICULTURAL STATION.

Block and plot.	Name of variety.	Previous crop.	Area of plot in acres.	Spacing.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
A / 9 *a*	4-F ...	Wheat, 1916-17 ...	½ ...	4 feet ...	2nd April 1918 ...	7th October 1918...	11th January 1919	5	29	9	11	19	2	
A / 9 *b*	„ ...	Ditto ...	½ ...	3½ „ ...	Ditto ...	Ditto ...	Ditto ...	6	30	14	13	21	12	
A / 10 *a*	„ ...	Ditto ...	½ ...	3 „ ...	Ditto ...	Ditto ...	Ditto ...	6	5	9	12	11	2	
A / 10 *b*	„ ...	Ditto ...	½ ...	2½ „ ...	Ditto ...	Ditto ...	Ditto ...	5	28	9	11	17	2	
A / 11 *a*	„ ...	Ditto ...	½ ...	4 „ ...	Ditto ...	Ditto ...	Ditto ...	5	10	11	10	21	6	
A / 11 *b*	„ ...	Ditto ...	½ ...	3½ „ ...	Ditto ...	Ditto ...	Ditto ...	5	20	2	11	0	4	
A / 12 *a*	„ ...	Ditto ...	½ ...	3 „ ...	Ditto ...	Ditto ...	Ditto ...	6	32	0	13	24	0	
A / 12 *b*	„ ...	Ditto ...	½ ...	2½ „ ...	Ditto ...	Ditto ...	Ditto ...	6	26	5	13	12	10	

Average outturn.	Mds.	Srs.	Chs.
4 ft. spacing.	11	0	4
3½ „ „	12	11	0
3 „ „	12	37	9
2½ „ „	12	14	0

Ploughings	6
Harrowings	13
Sohagaings	14
Hoeings	6
Waterings	5

Statement No. 5 *b*.

SHOWING THE RESULTS OF SPACING EXPERIMENTS WITH WHITE FLOWERED INDICUM BH. S. DURING KHARIF 1918.

Block and plot.	Name of variety.	Previous crop.	Area of plot in acre.	Spacing.	Date of			Actual outturn.			Outturn per acre.			Remarks.
					Sowing.	First picking.	Last picking.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
A / 16 *a*	White flowered Indicum Bhatia Selection.	Wheat, 1917-18 ...	½	2½ feet.	12th May 1918 ...	17th September 1918.	11th January 1919	3	7	3	6	14	6	
A / 16 *b*		Ditto ...	½	2 „	Ditto ...	Ditto ...	Ditto ...	3	16	8	6	33	0	
A / 17 *a*		Ditto ...	½	1½ „	Ditto ...	Ditto ...	Ditto ...	2	12	2	4	24	4	
A / 17 *b*		Ditto ...	½	2½ „	Ditto ...	Ditto ...	Ditto ...	1	23	14	3	7	12	
A / 18 *a*		Ditto ...	½	2 „	Ditto ...	Ditto ...	Ditto ...	0	31	2	1	22	4	These sub-plots are badly infected with kallar. Few plants here and there.
A / 18 *b*		Ditto ...	½	1½ „	Ditto ...	Ditto ...	Ditto ...	0	36	9	1	33	2	

Average outturn.	Mds.	Sers.	Chs.
2½ feet	9	22	2
2 feet	8	15	4
1½ feet	6	17	6

Ploughings	... ...	2
Harrowings	... ...	2
Sohagaings	... ...	1
Hoeings	... ...	4
Waterings	... ...	5

Statement No. 6 *a*.

SHOWING THE RESULTS OF BROADCASTING *VERSUS* SOWING IN LINE OF COTTON CROP EXPERIMENT GROWN AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1918.

Block and plot.	Name of variety.	Treatment.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Remarks.
D	White flowered ...	4 hoeings with kesola broadcast	31,620	4th May 1918 ...	8th September 1918	27th January 1919	8	$6\frac{5}{16}$	11	$5\frac{1}{2}$	
3			43,560								
D	Neglectum Bh. S. ..	Ditto in line ...	23,364	12th May 1918 ...	18th September 1918	Ditto ...	4	$20\frac{13}{16}$	8	$7\frac{1}{16}$	
4			43,560								

Statement No. 6 *b*.

SHOWING THE RESULTS OF DIFFERENT NUMBER OF HOEINGS WITH COTTON CROP EXPERIMENT CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1918.

Block and plot.	Name of variety.	Treatment.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Remarks.
D	White flowered Neglectum Bhatta Selection.	Two hoeings with kasola ...	41,050	4th May 1918 ...	8th September 1918	27th January 1919...	12	$14\frac{3}{16}$	13	$4\frac{1}{4}$	
1			43,560								
D		3 hoeings with kasola ...	27,616	Ditto ...	Ditto ...	Ditto ...	8	32	13	$19\frac{7}{16}$	
2			43,560								
D		4 hoeings with kasola ...	31,920	Ditto ...	Ditto ...	Ditto ...	8	$6\frac{5}{16}$	11	$9\frac{1}{4}$	
3			43,560								

Ploughing	...	...	1
Harrowing	...	...	1
Sohagaing	...	...	1
Hoeing	...	...	According to scheme.
Waterings	...	...	6

Statement No. 6 *c*.

SHOWING THE RESULTS OF DIFFERENT METHODS OF HOEINGS WITH COTTON EXPERIMENT CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1918.

Block and plot.	Name of variety.	Treatment.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Remarks.
D 4	White flowered Neglectum Bhatla Selection.	4 hoeings with Kasola ...	25,364 / 43,560	12th May 1918 ..	18th September 1918	27th January 1919...	4	20 1/16	8	7 1/16	Ploughing 1
D 5		4 hoeings with country plough.	2,790 / 43,560	Ditto ...	Ditto ...	Ditto ...	7	25 1/2	12	35 15/16	Harrowing 1
D 6		4 hoeings with horse hoe	32,594 / 43,560	Ditto ...	Ditto ...	Ditto ...	7	28 1/2	10	12 5/8	Sohagaing 1
D 7		4 hoeings with Gujrat hoe.	27,060 / 43,560	Ditto ...	Ditto ..	Ditto ...	7	38 11/16	12	3 7/8	Hoeing 4
											Watering 6

Statement No. 7.

SHOWING THE RESULTS OF DEEP AND SHALLOW CULTIVATION EXPERIMENT WITH COTTON CROP CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1918.

Block and plot.	Name of variety.	Treatment.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last packing.	Actual outturn. Maunds	Actual outturn. Seers.	Outturn per acre. Maunds	Outturn per acre. Seers.	Remarks.
D 8	White flowered Indicum Bhatla Selection.	Country plough ...	27,230 / 43,560	20th April 1918 ..	8th September 1918	27th January 1919 ..	8	1/8	12	31 1/2	Ploughing 1
D 9		Rajah plough (4½" deep)	34,195 / 43,560	Ditto ...	Ditto ...	Ditto ...	9	24	12	9 1/8	Harrowings 2
D 10		Sabul plough (9" deep)	41,520 / 43,560	Ditto ...	Ditto ...	Ditto ...	12	15 11/16	13	0	Sohagings 3
											Hoeings 4
											Watering 6

Statement No. 8.

SHOWING THE RESULTS OF EARLY AND LATE SOWING EXPERIMENT WITH COTTON GROWN AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1918.

Block and plot.	Name of variety.	Treatment.	Area harvested in acres.	Date of sowing.	Date of first picking.	Date of last picking.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	Remarks.
E 13 *a*	4-F	Early (sown in lines) ...	½	7th April 1918 ...	7th October 1918 ...	11th January 1919...	4	16	11	8	33	6	*Plot* 13. *Plot* 14.
E 13 *b*	Rosea Bh. S. ...	Ditto ...	½	Ditto ...	21st August 1918 ...	Ditto ...	4	24	15	9	9	14	Ploughings ... 4 1
E 14 *a*	4-F	Late (sown broadcast at 6 seers per acre seed rate).	½	6th May 1918 ...	7th October 1918 ...	Ditto ...	2	5	4	8	21	0	Harrowings ... 5 1
E 14 *b*	Rosea Bh. S. ...	Ditto ...	½	Ditto ...	17th September 1918	Ditto ...	1	32	5	7	9	4	Sohagings ... 9 1
E 14 *c*	4-F	Late (sown broadcast at 10 seers seed rate per acre). ...	½	Ditto ...	7th October 1918 ...	Ditto ...	1	32	5	7	9	4	Hoeings ... 4 3
E 14 *d*	Rosea Bh. S. ...	Ditto ...	½	Ditto ...	17th September 1918	Ditto ...	1	30	12	7	3	0	Waterings ... 5 5

Statement No. 9.

SHOWING THE RESULTS OF ASHES *VERSUS* NO ASH EXPERIMENT CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Block and plot.	Name of variety.	Area harvested in acres.	Treatment.	Date of			Actual outturn.		Outturn per acre.		Remarks.
				Sowing.	First picking.	Last picking.	Maunds.	Seers.	Maunds.	Seers.	
D / 15 *b* 1	4-F ...	¼ ...	No ashes ...	3rd April 1918 ...	7th October 1918 ..	11th January 1919	2	11¼	9	5	
D / 16 *a*	„ ...	¼ ...	Sticks standing ...	Ditto ...	Ditto ...	Ditto ...	2	$8\frac{13}{16}$	8	35¼	
D / 16 *b*	„ ...	¼ ...	Organic matter ...	Ditto ...	Ditto ...	Ditto ...	2	$17\frac{15}{16}$	9	31½	
D / 17 *a*	„ ...	¼ ...	Ashes ...	Ditto ...	Ditto ...	Ditto ...	2	20¾	10	3	
D / 17 *b*	„ ...	¼ ...	No ash ...	Ditto ...	Ditto ...	Ditto ...	1	$33\frac{5}{16}$	7	13¼	
D / 15 *b* 2	White flowered Indicum Bh . S.	¼ ...	No ash ...	Ditto ...	21st August 1918	Ditto ...	2	25¾	10	23	
D / 16 *c*	„	¼ ...	Sticks standing ...	Ditto ...	Ditto ...	Ditto ...	2	⅞	8	28½	
D / 16 *d*	„	¼ ...	Organic matter ...	Ditto ...	Ditto ...	Ditto ...	2	10¼	9	1	
D / 17 *c*	„	¼ ...	Ashes ...	Ditto ...	Ditto ...	Ditto ...	2	$8\frac{3}{16}$	8	32¼	
D / 17 *d*	„	¼ ...	No ash ...	Ditto ...	Ditto ...	Ditto ...	2	½	8	2	

Ploughings	...	4
Harrowings	...	2
Sohagings	...	5
Hoeings	...	4
Waterings	...	5

Statement No. 10.

SHOWING THE RESULTS OF HYDRAULIC EXPERIMENT CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1918.

Block and plot.	Name of variety.	Area harvested in acres.	Treatment.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
E 11 a^1	White flowered Neglectum Bh. S.	1/10	1 watering 5 hoeings	7th April 1918 ...	31st August 1918 ...	11th January 1919...	0	20	4	5	2	8	Ploughings ... 5 Harrowings ... 5 Sohagings ... 9 Hoeings ... According Waterings ... scheme.
E 11 a^2	„		2 waterings 4 „	Ditto ...	Ditto ...	Ditto ...	0	29	14	7	18	12	
E 11a^3	„		3 „ 3 „	Ditto ...	Ditto ...	Ditto ...	0	36	13	9	8	2	
E 11a^4	„		4 „ 2 „	Ditto ...	Ditto ...	Ditto ...	1	3	3	10	31	14	
E 11a^5	„		5 „ 1 hoeing	Ditto ...	Ditto ...	30th December 1918	0	39	11	9	36	14	
E 11b^1	4-F		1 watering 5 hoeings	Ditto ...	29th October 1918 ...	11th January 1919...	0	15	10	3	36	4	
E 11b^2	„		2 waterings 4 „	Ditto ...	Ditto ...	Ditto ...	0	34	8	8	25	0	
E 11b^3	„		3 „ 3 „	Ditto ...	7th October 1918 ...	Ditto ...	1	5	12	11	17	8	
E 11b^4	„		4 „ 2 „	Ditto ...	Ditto ...	Ditto ...	0	37	6	9	13	12	
E 11b^5	„		5 „ 1 hoeing	Ditto ...	Ditto ...	Ditto ...	1	6	5	11	23	2	
E 12a^1	White floweredIndicum Bh. S.		1 watering 5 hoeings	Ditto ...	21st August 1918 ...	Ditto ...	0	31	14	7	38	12	
E 12a^2	„		2 waterings 4 „	Ditto ...	Ditto ...	Ditto ...	0	37	10	9	16	4	
E 12a^3	„		3 „ 3 „	Ditto ...	Ditto ...	Ditto ...	1	7	0	11	30	0	
E 12a^4	„		4 „ 2 „	Ditto ...	Ditto ...	Ditto ...	0	36	7	9	4	6	
E 12a^5	„		5 „ 1 hoeing	Ditto ...	Ditto ...	Ditto ...		19	13	4	38	2	

Statement No. 11.

SHOWING THE RESULTS OF VARIETAL TEST OF WHEAT EXPERIMENT CONDUCTED AT THE HANSI AGRICULTURAL STATION DURING RABI 1918-19.

Block	Plot	Name of type.	Previous crops.	Date of Sowing.	Date of Harvesting.	Area harvested in acres.	Actual outturn. Grain. Maunds.	Actual outturn. Grain. Seers.	Actual outturn. Bhusa. Maunds.	Actual outturn. Bhusa. Seers.	Outturn per acre. Grain. Maunds.	Outturn per acre. Grain. Seers.	Outturn per acre. Bhusa. Maunds.	Outturn per acre. Bhusa. Seers.	Outturn per acre in term of standard. Grain. Maunds.	Outturn per acre in term of standard. Grain. Seers.	Outturn per acre in term of standard. Bhusa. Maunds.	Outturn per acre in term of standard. Bhusa. Seers.	Remarks.
A	5 & 6 / 1	Punjab 14 ...	4-F cotton...	13th November 1918.	11th April 1919 ...	2/16	3	22½	9	1¼	30	32 13/16	78	10 13/16	30	32 13/16	78	10 13/16	Ploughings 7
	5 & 6 / 2	8-A ...	Ditto ...	Ditto ...	17th April 1919 ...	2/16	4	17½	11	38½	38	18 5/16	103	27	33	11 6/16	87	24 9/16	Harrowings ... 9
	5 & 6 / 3	Punjab 14 ...	Ditto ...	Ditto ...	12th April 1919 ...	2/16	4	5	11	7½	35	30	96	38 5/16	35	30	96	38 5/16	Sohagings 9
	5 & 6 / 4	8-B ...	Ditto ...	Ditto ...	Ditto ...	2/16	3	12	10	8	28	24	88	16	34	20⅛	101	1⅛	Hoeing 1
	5 & 6 / 5	Punjab 14 ...	Ditto ...	Ditto ...	14th April 1919 ...	2/16	3	33½	12	5	33	10 5/16	105	3 5/16	33	10 5/16	105	3 5/16	Waterings 3
	5 & 6 / 6	9-C ...	Ditto ...	Ditto ...	12th April 1919 ...	2/16	4	4	10	12½	35	21 5/16	89	15	34	2⅛	94	33 13/16	
	5 & 6 / 7	Punjab 14 ...	Ditto ...	Ditto ...	Ditto ...	2/16	4	1	9	30½	34	35 5/16	84	24 5/16	34	35 5/16	84	24 5/16	
	5 & 6 / 8	17-B ...	Ditto ...	Ditto ...	Ditto ...	2/16	3	19	9	0	30	4⅛	78	0	33	18 1/16	78	36 13/16	
	5 & 6 / 9	Punjab 14 ...	Ditto ...	Ditto ...	Ditto ...	2/16	3	28	8	18	32	2⅛	73	9 5/16	32	2⅛	73	9 5/16	
	5 & 6 / 10	20-C ...	Ditto ...	Ditto ...	Ditto ...	2/16	3	9	8	1	27	38	69	22	32	6 1/16	79	7⅛	
	5 & 6 / 11	Punjab 14 ...	Ditto ...	Ditto ...	14th April 1919 ...	2/16	3	29	9	33	32	11 5/16	85	6	32	11 5/16	85	6	
	5 & 6 / 12	Punjab 11 ...	Ditto ...	Ditto ...	17th April 1919 ...	2/16	4	6½	9	26½	36	3	83	29⅛	32	15⅛	87	21 5/16	
	5 & 6 / 13	Punjab 14 ...	Ditto ...	Ditto ...	Ditto ...	2/16	3	30	10	15	32	20	89	30⅛	32	20	89	36⅛	
	5 & 6 / 14	Punjab 17 ...	Ditto ...	Ditto ...	Ditto ...	2/16	3	17	10	3	29	27 5/16	87	12⅛	31	38 5/16	93	2 5/16	
	5 & 6 / 15	Punjab 14 ...	Ditto ...	Ditto ...	Ditto ...	2/16	3	25	11	4	31	16⅛	96	8	31	16⅛	96	8	
	5 & 6 / 16	Pusa 12 ...	Ditto ...	Ditto ...	Ditto ...	2/16	1	9	4	21	10	24⅛	39	8⅛	21	10/16	67	28 5/16	Badly drained soil always shaded by trees.
	5 & 6 / 17	Punjab 14 ...	Ditto ...	Ditto ...	Ditto ...	2/16	1	17	5	15	12	14	46	23 5/16	10	24⅝	39	8⅛	

7 & 8 / 1	Punjab	14	...	4-F. cotton	13th November 1918	12th April 1919 ...	3/26	3	24½	8	39	31	12 5/16	77	31 5/16	31	12 5/16	77	31 5/16
7 & 8 / 2	Pusa	12	..	Do.	Ditto	10th April 1919 ...	3/26	2	26½	6	17½	23	3	55	31⅝	31	23⅛	73	5
7 & 8 / 3	Punjab	14	...	Do.	Ditto	11th April 1919 ...	3/26	3	27	7	36	31	34	68	18⅝	31	34	68	18⅝
7 & 8 / 4	,,	17	...	Do.	Ditto	Ditto ...	3/26	3	37¼	7	32¾	34	21 13/16	67	30½	32	4 13/16	72	23 5/16
7 & 8 / 5	,,	14	...	Do.	Ditto	Ditto ...	3/26	3	29½	8	34	32	15⅝	76	28	32	15⅝	76	28
7 & 8 / 6	,,	11	...	Do.	Ditto	Ditto ...	3/26	3	35	8	10	33	28 6/16	71	20	33	34⅛	86	22 5/16
7 & 8 / 7	,,	14	...	Do.	Ditto	14th April 1919 ...	3/26	4	3	11	5	35	12⅝	96	16⅝	35	12⅝	96	16⅝
7 & 8 / 8	,,	20-C	...	Do.	Ditto	Ditto ...	3/26	3	31	8	34½	32	28⅝	76	32 5/16	33	25½	89	30½
7 & 8 / 9	,,	14	...	Do.	Ditto	Ditto ...	3/26	3	27½	9	23½	31	30 5/16	83	3⅝	31	38 5/16	83	3⅝
7 & 8 / 10	17-B		...	Do.	Ditto	Ditto ...	3/26	3	24	10	10	31	8	88	33 5/16	32	17 13/16	83	34
7 & 8 / 11	Punjab	14	...	Do.	Ditto	Ditto ...	3/26	3	32	9	30½	32	37 5/16	84	24 5/16	32	37 5/16	84	24 5/16
7 & 8 / 12	9-C		...	Do.	Ditto	13th April 1919 ...	3/26	3	32	9	13	32	37 5/16	80	30⅝	34	18	83	18 3/16
7 & 8 / 13	Punjab	14	...	Do.	Ditto	14th April 1919 ...	3/26	4	6	9	20	35	38⅝	82	13 5/16	35	38⅝	82	13 5/16
7 & 8 / 14	8-B		...	Do.	Ditto	Ditto ...	3/26	3	17	8	31½	29	27 5/16	76	6 5/16	33	14 10/16	77	9 10/16
7 & 8 / 15	Punjab	14	...	Do.	Ditto	Ditto ...	3/26	3	22	8	13	30	30⅝	72	6	30	30⅝	72	6
7 & 8 / 16	8-A		...	Do.	Ditto	17th April 1919 ...	3/26	2	35	6	18	24	36⅝	55	36	23	20⅝	57	14½
7 & 8 / 17	Punjab	14	...	Do.	Ditto	Ditto ...	3/26	1	35	4	36½	16	10	42	23	16	10	42	23

Badly drained soil always shaded by trees.

Statement No. 12.

SHOWING THE RESULTS OF DEEP AND SHALLOW CULTIVATION EXCEPT ON WHEAT CONDUCTED AT THE HANSI AGRICULTURAL STATION DURING RABI 1918-19.

Block and plot.	Name of type.	Treatment.	Area harvested in acres.	Actual outturn.				Outturn per acre.				Remarks.
				Grain.		*Bhusa.*		*Grain.*		*Bhusa.*		
				Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	
B/8	S-B	Country plough ...	1 acre	22	20	60	35	22	20	60	35	
B/9	Do.	Rajah plough 4½" leep ...	Do.	22	34	56	5	22	34	56	5	Land was recently levelled.
B/10	Do.	Sabul plough 9" deep ...	Do.	25	27	78	12	25	29	78	12	

Ploughings 6

Harrowings 7

Sohagings 9

Hoeings 4

Waterings 3

Date of sowing—14th November 1913.

„ „ harvesting—13th to 14th April 1918.

Statement No. 13.

SHOWING THE RESULTS OF VARIETAL TEST EXPERIMENTS WITH SUGARCANE DURING KHARIF 1918.

Block and plot.	Name of variety.	Area harvested in acres.	Actual outturn.								Outturn per acre.						Percentage of juice to cane.	Percentage of gur to juice.	Percentage of gur to cane.	Remarks.
			Unstripped canes.		*Tops.*		*Stripped canes.*		*Juice.*		*Gur.*		*Stripped canes*		*Juice.*		*Gur.*					
			Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Mnads.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.				
13*a* *a*	Local Jkh	¼	171	26½	28	9	121	33½	68	31	11	29	487	14	275	4	46	36	56·4	17·04	9·6	
13*b* *a*	Dhaura „	¼	150	18½	43	3½	81	35½	44	21	7	14½	327	21	178	4	29	17	54·37	16·5	8·9	
14*a* *a*	Mango „	¼	128	29½	35	22	59	9½	36	16½	5	35½	236	38	145	26	23	22	61·4	16·1	9·9	
14*b* *a*	Lalri „	¼	119	11	22	30	75	25	40	38	7	2	302	20	163	32	28	8	54·3	17·2	9·3	
15*a* *a*	Suretha „	927 / 4,356	130	17	23	36	80	4	28	35	6	16¾	376	15	135	27	30	6	36·14	22 3	8·01	
15*b* *a*	Local „	¼	128	30	24	35½	81	19	45	14½	7	35¼	325	36	181	18	31	21	55·68	17·37	9·6	
13*c* *a*	Local „	¼	186	10½	32	20½	123	½	67	½	11	28¼	492	2	268	2	46	33	5 ·48	17·47	9·52	
13*d* *a*	Suretha „	¼	160	33	28	8	111	1½	64	12	11	10	444	6	257	8	45	0	57·90	17·49	10·13	
14*c* *a*	Lalri „	9,090 / 43,560	154	38	22	27	107	39	62	2	10	18¼	517	16	297	13	50	4	57·47	16·85	·68	
14*d* *a*	Mango „	8,910 / 43,560	144	22	32	2	84	14	41	34	6	21⅞	412	15	204	24	31	0	49·61	15·64	7·76	
15*c* *a*	Dhaura „	9,018 / 43,560	174	3½	41	14	100	½	54	24	8	36⅛	483	3	263	29	43	0	54·59	16·38	8·9	
15*d* *a*	Local „	8,480 / 43,560	117	12	23	35½	66	16¾	35	26	5	33½	343	8	184	8	30	6	53·67	16·36	8·79	

Ploughings ... 9

Harrowings ... 4

Sohagings ... 25

Hoeings ... 8

Weedings ... 17

Date of sowing 17th March 1918.

Statement No. 14 *a*.

SHOWING THE RESULTS OF COMPARATIVE TEST OF BARLEY TYPES GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1918-19.

Serial No.	No. of Block and plot.	Name of type.	Area sown in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Remarks.
												Harvested on.
1	E/15	Local barley ...	1/10	1	33½	1	25	18	15	16	10	3rd April 1919.
2		Type No. 1 ...		2	30½	2	23	28	5	25	30	6th April 1919.
3		Local barley ..		2	26	1	27	26	20	16	30	3rd April 1919.
4		Type No. 2 ...		3	0	2	26	30	0	26	20	5th April 1919.
5		Local barley ...		2	27	2	5	29	10	21	10	1st April 1919.
6		Type No. 4 ...		2	33½	1	16	28	15	14	0	Do.
7		Local barley ...		2	25	1	17	26	10	14	10	Do.
8		Type No. 5 ...		2	22	1	30	25	20	17	20	3rd April 1919.
9		Local barley ...		2	15	1	5	23	30	11	10	1st April 1919.

Ploughings ... 5
Harrowings ... 7
Sohagaings ... 8
Hoeings 3
Waterings ... 2
Date of sowing—15th November 1918.

Statement No. 14 *b*.

SHOWING THE RESULT OF COMPARATIVE TEST OF GRAM VARIETIES GROWN AT THE HANSI AGRICULTURAL STATION, HANSI, DURING RABI 1918-19.

Serial No.	No. of block and plot.	Name of variety.	Area sown in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers	Remarks.
1	E/12 *b*.	Local gram ...	1/32	0	5¼	0	4	4	8	3	8	
2		Type No. 7 ...		0	4	0	5	3	8	4	0	
3		Local gram ...		0	10¼	0	11½	8	8	9	8	
4		Type No. 15 ...		0	10¾	0	11	8	24	8	32	
5		Local gram ...		0	15¾	0	17½	12	24	14	0	
6		Type No. 17 ...		0	15¾	0	18	12	24	14	16	
7		Local gram ...		0	24¾	0	27½	19	32	22	0	
8		Type No. 20 ...		0	12¾	0	21½	10	8	17	18	
9		Local gram ...		0	24	0	25	19	8	20	0	
10		White Burma No. 1 ...		0	22½	0	28½	18	0	22	32	
11		Local gram ...		0	25¼	0	28½	20	8	22	32	
12		White Burma No. 2 ...		0	18¼	0	28½	14	24	22	32	
13		Local gram ...		0	20¼	0	25½	16	8	20	16	
14		Black Burma ...		0	22¼	0	28	17	32	22	16	
15		Local gram ...		0	21½	0	26	17	8	20	32	

Ploughings 3
Harrowings 3
Sohagaings 3
Hoeings 1
Waterings ... ...

Statement No. 15.

STATEMENT SHOWING THE COMPARATIVE RESULTS OF SARSON AND MUSTARD VARIETIES GROWN AT THE HANSI AGRICULTURAL STATION IN RABI 1918-19.

Serial No.	No. of field.	Name of variety.	Area sown in acre.	Actual outturn.		Outturn per acre.		Remarks.
				Maunds.	Seers.	Maunds.	Seers.	
1	27	Local Sarson	¼	1	11	5	4	
2		Brown Mustard		0	2½	0	10	Seed deteriorated in size and colour.
3		Local Mustard ...		1	23½	6	13	
4		Yellow Mustard		0	24½	2	19	Ditto.
5		Brown Mustard ...		0	10½	1	2	
6		Local Mustard		1	18½	5	26	
7		Yellow Mustard		0	11½	1	5	Ditto.
8		Local Sarson		1	4	4	16	

Ploughings	... 2
Harrowings	... 3
Sohagings	... 2
Waterings	... 2

Experiments in Economic Botany by Mr. D. Milne, Economic Botanist.

Staff.

The following additions have just been made to the staff of the Section :—

(*a*) One Demonstrator for College Teaching work.

(*b*) One man to assist with the field work in the Botanical Section at Lyallpur.

(*c*) One man to be manager of the new Date Farm at Muzaffargarh.

The first mentioned assistant has had a four years' training in the Agricultural College and the last two men a two years' training there.

Cottons.

Remarks regarding area of land, quality of soil, temperatures, rainfall, and their general effects on the crop.

As was the case in the year previous to that under report 18 acres of land were available for the growing of experimental cotton. 10 acres of this were in the old area (*viz.*, square No. 46) and 8 acres in the newly acquired area (square. No. 31).

Desi and American varieties were grown interstripped in long, narrow plots as in previous years. Altogether about 80 types of American Cotton and 96 of Desis were under trial. About half of the cottons were sown in the last 10 days of April and the remaining half during early May. Zemindars' cottons in the canal irrigated tract were sown about this time also. In square No. 46 the area consisted chiefly of the poor sandy piece of land frequently referred to in former years. Only a little over an acre was of fair quality. In square No. 31 about 5 acres were of good quality.

The average daily maximum temperatures for the month of May were 3° F.; in June, 0·3° F., in July, 2·7° F.; and in August 1·6° F. above normal. The remainder of the season was not abnormally hot. There were no frosts to hurt the crop in the end of the year. Practically no rain fell from sowing time till the 15th of July when there were about 1¼ inches precipitation. There was no further rain till 20th August when for a period of 20 days the sky remained cloudy and there were occasional showers. The remainder of the season was not remarkable as far as rains are concerned.

On the poor sandy lands the American Cotton plants were under-sized; their lint was irregular in length and strength, and generally of very poor quality as we have constantly found to be the case when Americans are grown on such lands. The desi (Indian) cottons on such lands were as usual more near their normal size; the amount of kapas (unginned cotton) borne was considerably less than on fair quality of land but outturn of kapas and the length and strength of the lint were less impaired than in the case of Americans These lands, owing to their physical compositions, are excessively drained, and this, as we have stated for many years back now, is the key to the whole case. The desi cottons are more xerophytic in character than the Americans, therefore they attain a more normal size in such conditions. Also their lint, being normally shorter and stronger, is less easily affected as regards length and strength.

As would be expected, desi cottons, although yielding a poor crop on these lands, yield rather more than Americans do there.

On fair quality of land with fair cultivation and timely irrigation however our selected acclimatized American Cottons generally yield rather heavier crops than our selected desis, and very much heavier crops than unselected desis.

On our experimental lands the crop under report suffered heavily from the high temperature and drought in May, and there were general complaints from the farmers in the Canal Colonies that a large number of young cotton plants had dried up and died in that month. Farmers generally believed that this was due to some insect or fungal attack; but it was merely due to the abnormally high temperatures and drought which desiccated the tiny plants before they were able to develop a sufficient root system to replace the amount of water evaporated through their leaves. That this was so, was shown by the fact that in cases where they were irrigated they survived. Owing also to heat and drought the plants dropped most of their first formed flowers, and this resulted in first pickings being very poor. We have found however that when the first flowers are dropped by the plants, flowering tends to continue unusually late if the remaining part of the flowering season is favourable; and some compensation is got from an increase in amount of crop yielded in the later pickings if no early frosts occur. In the year under report the plants made extraordinarily rapid growth in the damp days of August-September, and there being no frost the compensation got in this way almost brought the crop up to normal.

Outturns of kapas on the experimental lands.

As regards outturn on moderately good land on our half acre plots, the American Cotton No. 285 F topped the list. It was grown on 4 half acre plots and one of these gave an outturn of kapas at the rate of 21 maunds 10 seers per acre. This plot had been manured with city refuse a number of years ago; but the soil of about ⅓ of it is naturally hard and unsuitable for cotton growing. The plants in this hard portion of the plot were undersized, while on the remainder the plants were well grown and bore heavily. On

another plot of 285 F a crop of 15 maunds and 21 sees per acre was got. One-third of the land was again very hard and many of the plants on the other ⅓rds were destroyed by root-rot. The remaining two plots yielded 12 maunds and 11 maunds and 9 seers of kapas per acre respectively (see statement A).

These two plots consisted of light sandy soil.

Many other selections of American Cotton gave very promising results when all factors affecting the economic value of the crops produced by them are considered.

Among the desi cotton selections on the half acre plots G. Neglectum Var. Roseum No. 132 gave the highest outturn of kapas. This was 18 maunds and 22 seers per acre on the plot alongside the plot of 285 F which gave 21 maunds and 10 seers per acre. This plot had been manured along with the 285 F plot and was in every other respect very similar to it, as far as soil and treatment are concerned. A second half acre plot of G. Neglectum Var. Roseum No. 132 gave 15 maunds and 13 seers per acre. The germination in this case was not regular and about ¼ of the land had practically no plants on it at all. The first sowing of a third half-acre plot of this variety failed, and as the second sowing was done on 15th June the case cannot be compared with the others. Various other selections of desi cotton did very well. On light sandy plots the outturns of kapas from the desis are, as usual, higher than those of American varieties interstripped with them. The desi selections referred to and a number of others are all obviously better than the local desi mixtures but for good reasons Americans are in favour with farmers wherever there is a chance of growing them with any success.

Experiments with newly imported cottons.

A number of varieties of American Cotton imported direct from America in 1917 were grown in the Experimental Area for the first time in the year under report (1918) as they arrived too late for the sowing in 1917. They were named as follows:—

1. Dads Prolific.
2. Myaths early Prolific.
3. Cleveland big bolled.
4. Do. 0-27-11-24.
5. Do. Wamnamaker.
6. Express 341.
7. Trice.
8. Cooks Cotton.
9. Lone Star.
10. Simkins Ideal, and.
11. Perry.

As has always been the case on the several occasions on which we have imported cottons direct from America, the crops were a miserable failure from an ordinary farmer's point of view. The leaves and bracts were large and thick and even in the comparatively dry season of 1918 they showed some signs of attack by "Jassid" insects. It has been repeatedly shown that it is useless to expect freshly imported cotton seed from America to be a success here. In America cottons are sown at about the same time as they are here; but the rainfall and the general humidity of the atmosphere in the cotton belt of the United States of America are far higher than in the Punjab plains. Also our mean temperatures are very much higher. In May the mean temperature of the main cotton districts of the Punjab is over 20° F. higher than the mean temperature in the American Cotton Belt. This difference gradually drops to over 8° F. higher in August and again rises to over 14° F higher in December. The cottons here have therefore to possess much more drought resisting character than those suitable for the American Cotton Belt. Such differences in the environments account for the behaviour of our newly imported cottons, and give the key to the direction in which work on producing suitable types of American Cotton for the Punjab must proceed.

Topping of cotton plants.

As American cottons give their last picking in December and even January and the quality and quantity of these pickings are affected if we have frosts, it is desirable to induce the plants to yield their final pickings earlier than they do. There may also be cases in which it would be desirable to hasten the crop in the case of desi cottons. For a number of years back therefore attempts, severely handicapped for want of staff, have been made to see the effect which "topping" the plants, *i.e.*, cutting off the tops of the main stem and of the vegetative branches at the beginning of the flowering time would have in this direction. Experiments were carried out on both American and Desi cottons and the general result indicates that in years of normal growth the topped plants do yield earlier and fully as heavily, while in years of luxuriant vegetative growth the yield appears to be earlier and considerably increased. It is hoped that staff will be available soon to further investigate this and many other problems which we have already touched, or have in hand.

Valuation of cotton lints.

27 samples of American and 6 of desi cotton lints were sent to Messrs. Tata Sons & Co., Bombay, for valuation and opinion. A copy of their report is appended (see Annexure 1). It will be seen that Scind American and Combodia cottons were selling on the day of valuation @ Rs. 625 and Rs. 650 per candy (784 lbs) respectively; while the highest valued of our types, *i.e.*, 289 F., was valued @ Rs. 900 per candy. This cotton is classed as long stapled African cotton, and is reported to spin 60 s.

Type No. 285 F. stands second. It is reported as "far better than American middling" "good for spinning 50 s" and valued at Rs. 850 per candy.

Three other selections were valued at Rs. 800 per candy, seven at from Rs. 750 to Rs. 780 per candy; others from that downwards, all being valued above Scind American except two samples, one of which was equal to it and the other lower by Rs. 10 per candy.

All these American Selections are very much better in quality of lint than 4F. 4F would hardly be as good as the 126F mentioned in Messrs. Tatas' report under consideration.

The lints of the desi cottons valued by Messrs. Tata are short and rough. Any merit that these cottons have, lies in their hardiness, cropping powers, ginning percentage of their kapas, etc.

285F which has been growing on our experimental area for a considerable number of years now has attracted the attention of a good many farmers. In the year under report a farmer named Nur Muhammad Khan Lambardar of Chak 232 R. B. grew one acre of 285F in his Chak. He grew the American Cotton 4F. in his land around it. The 285F and some of the 4F plots followed a wheat crop while some of the other 4F plots followed Toria. Both 285 and 4F were sown broadcast and treated by ordinary Zemindari methods. 4F was sown in the end of April while 285F was sown in early May, therefore 4F plants had become better established than the 285F plants before they had to face the high temperatures in May. This resulted in 285F having a much thinner stand of plants than 4F. In spite of this however 285F gave the farmer 12 maunds of kapas per acre while 4F in the surrounding plots gave him from 6 to 9 maunds per acre. The actual number of plants in the 285F plot was 1,800. Unfortunately the 4F plants were removed from their plots before we had time to count them; but although the numbers per acre in their cases were also low, they were obviously very much higher than in the case of 285F. The bolls of 285F. are larger than those of 4F and in the case just quoted the kapas from about 190 bolls of 4F weighed 1 lb. while it required kapas from only about 125 bolls of 285F to make 1 lb. weight.

As the kapas of 285F which had been grown on our land was being ginned at a Lyallpur ginning factory we were offered Rs. 60 per maund for the lint, offers for good 4F there on the same date being Rs. 48 per maund.

The kapas of 285F like that of 4F yields nearly 33 per cent. of lint; therefore comparing the value of the 285F crop on Nur Muhammad's land with that of his best 4F plot, the figures would be approximately as follows:—

(*a*) In the case of 285F yielding 12 maunds kapas per acre—

	Rs.
156 seers of lint at Rs. 60 per maund	234
324 seers of seeds at Rs. 6 per maund	48
Total ...	282

(*b*) In the case of 4F yielding 9 maunds of kapas per acre—

	Rs.
117 seers of lint at Rs. 48 per maund	140
243 seers of seeds at Rs. 6 per maund	36
Total ...	176

i.e., a difference of clear profit in favour of 285F of Rs. 106 per acre.

Note.—1 seer = $\frac{1}{40}$ maund.

1 maund = $82\frac{2}{7}$ lbs.

Nur Muhammad Khan states that he has had a large number of requests for the seeds of this variety from his neighbours and friends who saw his crop growing, and that he has sold his surplus seeds to them not at Rs. 6 but at Rs. 9 per maund.

In the several years in which we have grown this variety it has kept up its reputation for high cropping and lint qualities.

Two bales of this variety and one bale of 4F. have been sent to the British Cotton Growing Association, Manchester, but a report is not yet to hand. However the British Cotton Growing Association has already valued a small sample of lint from this variety and remarks as follows:—

"But 285F. is a most excellent result for India and is a cotton which would be quite suitable for the Lancashire Market, being worth about 400 on American futures," *i.e.*, 4*d.* per pound better than middling American. Apparently middling American was selling on the date of this valuation at 16*d.* per pound.

It has been estimated by other officers that in the year under report alone, the American Cotton 4F. yielded one crore and 20 lakhs of rupees more to the farmers of the Punjab than they would have had, had they grown their ordinary unselected desis, and so far as I can see 285F. grown on fair quality of land with fair cultivation and irrigation should be another very important step in advance.

Our special experience in cotton testing work has shown us however that the system of having the cottons which we evolve finally tested by people not in the Botanical Section and who have not had either the necessary training in Economic Botany nor the opportunity of making a special study of type testing work, has hindered the progress of the cotton work to a most serious extent. It has also caused a great deal of friction in the Department for the Botanical Section must either point out where the methods of final testing are wrong when they see that they are so, or see the work which they have spent years of patient labour on, go to pieces or be misrepresented by misleading data collected. We have seen that when our crop types are tested by other sections the results got in one year often contradict those got in the same section in the next, and later results contradict both. Real progress is thereby retarded and the Province is the loser. The cause is misinterpretation of the effects of the factors involved, and the remedy is to keep the testing work in the hands of specialists. It costs Government exactly the same whether the facilities for this testing are under one officer or under another. Unfortunately however it has never been realized that this is a specialist's work of vital importance to progress, also that the work must be organised in such a way that any misinterpretation of results will rebound to the loss of those who misinterpret. Every year emphasizes afresh the grave necessity for this step to be taken. I mention this as at present good cotton work is of intense value to the Empire and the loss which our decade of experience shows has already been caused, must have been very great. The work on both desi and American cottons is very far behind where it might have been with the same staff but with an altered organisation. The report of the Indian Cotton Committee impresses us with the necessity for rapid and accurate decisions regarding new types, and this can only be done if the work is in the hands of specialists. I sincerely hope that those who evolve types of cotton will be allowed to test them to a finish soon. It is quite obvious that whoever the parties concerned may be it will be quite impossible to get the best results of work done in the Botanical Section until the anomaly of having laymen making the final tests of specialists' work is removed.

Wheat.

General. Two blocks of land set apart for wheat growing, one of 10 acres, covering parts of squares Nos. 28 and 46, and the other of 8 acres in square No. 31 were under wheats in the year under report. The previous crop on these blocks was cotton and it was removed in January 1918. About 6½ acres of the 10 acre block were medium loam, while 3½ acres were sandy loam. The 8 acre block was all more or less a sandy loam. Over 250 different sowings of wheat were under trial.

Cultivation and irrigation. Between the time the cotton crop was removed and the wheats were sown, the land got the following treatment :—

One ploughing with Raja plough in January. Two cultivations with spring-toothed harrow, and two ploughings with country plough in summer.

To prepare the wheat seed bed the land received one irrigation and two ploughings with a country plough.

While the crop was growing one weeding was done and three irrigations were given, but on 6 acres of very sandy land an extra watering had to be given in January to check a severe attack of white ants on the young plants.

Season. As will be seen from the data given below, the wheat growing season was rather dry :—

Name of month.	*Rainfall in inches.*
June	·09
July	·82
August	3·29
September	·57
October	·16
November	...
December	·43
January	1·27
February	·27
March	·26
April	·26
May	·72
Total ...	8·14

Rain which fell in the end of January checked attacks of white ants which were specially serious on late sown wheats in light sandy lands and which had not been irrigated after sowing till then. It also benefited all wheats greatly. Harvesting was interfered with by occasional showers of rain in the end of April and in May, but no serious damage was done by these rains to our wheat crop.

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Diseases.

Owing to an almost clear sky in February and March rust made its appearance later than usual and did not do much damage. As already indicated white ants did a good deal of damage to the crop about the middle of January especially on dry light sandy soil. The extra watering given by us to the worst cases washed down a good deal of the soluble plant food-materials in the soil, beyond the reach of the roots, and although the white ants attack was checked, the plants became pale and stunted in growth. The yields were therefore affected in these cases. We have not had such a severe attack of white ants in wheat during the past 10 years.

A few remarks on the effect on the crop of differences in quality of land and of climate.

In this connection I may note that light sandy soils require light and frequent waterings in order to keep the soil moist and avoid washing the plant food-materials beyond the reach of the roots.

We also find that on rich soils the crop should not be sown early as the vegetative growth becomes too rank, the plants lodge before the grains are filled, and the yield of grain is reduced. Even the number of spikelets in the heads are reduced if the growth is so rich that the plants fall over before all the spikelets are formed.

Soft grained types tend to produce harder grains in drier conditions of soil and climate, aud when the soil is poor in plant food-materials, as is usually the case on very light sandy lands, normal hard grained types yield grains with soft light coloured spots on them, which give them a mottled appearance. Mottled grains are also found in such wheats on medium or good soils if water is insufficient at the time of development and ripening of the grain. The amounts of water and soluble plant food-materials in the soil also tend to affect the earliness or lateness of ripening of a type. Plenty of water and available food-materials tend to continue vegetative growth and to delay ripening. As much as a week of difference in the date of ripening may be caused in this way. Again, thin germination also tends to make a wheat later in ripening if other factors are favourable. In this case the plants tiller more. In the Punjab plains we do not want wheats, the normal date of ripening of which is beyond the third week of April, as the temperatures after that time tend to rise so high that the plants dry up as if ripening whether they are ready for ripening or not. The latest safe date of ripening however varies in different parts of the Province, being generally earlier in the East and later in the West.

Moist lands and a thick stand of crop tend to produce more rust on wheats, and we have frequently seen the same type of wheat less rusted on sandy soil than on loamy soil.

The 25 originally classified types of Punjab wheats.

The 25 originally classified types of Punjab wheats were grown on small plots to keep up the stock of seeds and for demonstration and crossing purposes.

Types of wheat discovered during our district surveys.

Thirty-six types of Punjab wheats discovered during wheat surveys which we are conducting annually, district by district, were also grown on long long narrow 1/32 acre plots interstripped at intervals with similar plots of Punjab No. 9 as a standard. With the exception of types Nos. 4A, 8C, 16A, 19J and 19K which have been grown for four years only, they have all been similarly grown for the past seven years in plots of 1/32 to 1/4 acre area according to the land available. Omitting the outturns got in the season 1913-14 when the crop was destroyed by a severe hail storm and also the outturns of certain plots obviously abnormal for some reason or another, the average outturns got up to date place them in the following positions :—

Type No.	*Marks*
4A.	112.
16A.	110.
19K.	103.
8A.	102.
17B.	101.
8B.	101.
19G.	100.
19C.	100.
19H.	99.
25C.	99.
20B.	99.
19D.	97.
19F.	95.
17C.	95.
19B.	94.

Type No.	*Marks.*
18A.	94
20C.	94
23A.	93
19I.	93
19J.	93
19C.	93
19A.	93
8C.	92
19E.	91
9A.	90
17A.	89
20A.	89
25B.	89
24A.	88
25A.	88
9B.	86
24B.	86
20E.	83
20D.	82
24D.	82
24O.	81

To get the above marks the outturn in each standard plot was always taken as representing 100 and the outturn which would be equivalent to 100 on any particular plot of the other types was fixed in each case after consideration of the outturns of the standard plots on either side of it. The number of marks given to the variety under consideration was then in the proportion of its outturn to the fixed amount. Although the data got gives some indication of the relative cropping powers of the types, they indicate that the standards were not as close as they should be. Unfortunately however we have had neither land nor staff enough to do better in this respect. They also further emphasize my opinion that to grow wheat types on half acre plots of 22 yards width side by side with a standard, on most lands about Lyallpur exposes us to the danger of collecting most misleading data which will hinder real progress. Also that so many factors affect the outturns that progress can only be made in the most carefully laid out experiments if the work is in the hands of specially trained men. Even then it is difficult enough to gauge accurately the influence of the numerous factors which may be affecting the cases.

As regards lodging at ripening time the following types stand particularly well :—

4A.
17C., 18A.
20A., 20B., 20C., 20D., 20E.
19E., 19F., 19G., 19H.
8B., 19I., 19J., 19K.
25B., 25C.

and in the above order, those bracketted together being about equal.

The remaining types come in the following order :—

8A.
16A.
9C.
17A. } 17B.
23A.
8C. } 9A. } 9B.
19A. } 19B. } 19C.
19D.
25A. } 24A. } 24B. } 24C. } 24D.

Regarding rust resistance they may be grouped in three classes and placed in the under noted order in these classes :—

Class I.	4A.
	8B.
	8A.
	16A.
Class II.	17A. } 17B.
	20A. } 20B. } 9C.
	19D. } 19A. } 19B. } 19C.
	19J.
	20D. } 20E.
	9A. } 9B.
	18A.
	23A.
	24A. } 24B. } 24C. } 24D.
	17C.
	25B.
	19E. } 15F. } 19G. } 19H. } 19I.
	19K. } 20C.
Class III.	8C.
	25A.
	56C.

4A stands at the top as far as yield, standing power and rust resistance are concerned, but unfortunately it is a dwarf wheat (T. Compactum) and is therefore of no use for export purposes, its grains being too small.

16A is second as far as outturn is concerned. It is a bearded amber hard grained wheat belonging to the T. Vulgare group (common wheats).

As regards standing power it is second from the top in the second group, but heavy yielders naturally do not stand as well as light yielders with the same strength of straw. This is a fertile source of error with beginners at the work. I may also note that for fodder purposes farmers want as fine straw as possible. Therefore our aim is to get a straw that will just carry a full head without falling over. This type stands as well as Punjab 14. It is in the first group as regards rust resistance. Where Punjab 14 is generally grown it may do well, but as stated above we have only had it four years.

19K. which stands third in outturn also belongs to the Vulgare group. It is a beardless moderately hard but red grained type. As regards standing powers it is near the bottom of the first group, and near the bottom of the second group as regards rust resistance. It may be very useful in crossing work.

8A. comes next on the list as regards yield. It is in the first group as regards rust resistance and at the top of the second division regarding standing powers. Its straw is as strong as that of Punjab 11, but being a heavier cropper it is slightly more inclined to bend over just at the ripening time. This wheat has been in our hands since 1910 and in the Botanical Section tests has annually beaten the best types of wheat at present available to Punjab Zemindars. This year its outturn is 32 maunds and 36 seers per acre on a 1/4 acre plot while similar plots of Punjab 11 on either side of it gave 30 maunds and 32 seers, and 30 maunds and 28 seers respectively.

It was handed over to the Professor of Agriculture, Punjab, for trial on the Lyallpur Agricultural Farm in 1914 and appears to be the heaviest cropper where the test plots have been most comparable. For example on square No. 26, which is under direct cultivation of the Farm, it has been grown annually since 1915 and has constantly beaten Punjab 11. 8A was handed over to the Deputy Director of Agriculture, Hansi, in 1915 and in the past three years has topped the list of outturns. It was handed over to the Deputy Director of Agriculture, Gurdaspur, in 1915, and it appears to be the best wheat there. The Deputy Director of Agriculture, Gurdaspur, had also grown it on the Sargodha Seed Farm for two years and again where the tests were most comparable it has done best of all the wheats under trial.

In cases where this type has been grown outside the Botanical Section and this result has not been got, inspection or enquiries usually show us room for the discrepancy. At every turn however experience reiterates the vital need for all testing work to be done under men specially trained for it, and that the organisation should be such that any misinterpretation of results should recur to the loss of the person in charge. Any other arrangement results in the collection of misleading data and consequent hinderance to sound progress. Differences in results got, after even the most qualified workers have brought their knowledge and experience to bear on such cases, show that this work is by no means simple. Were this not so the world would have been flooded with improved plants by now, for in every ordinary crop there are plants differing in character to some extent.

Farmers like 8A because among other things it is bearded and has amber moderately hard grains which do not shed easily when ripe ; tillers and crops well on ordinary zemindari lands, etc. They find that it is less easily weeviled in the store than Pusa 12 and they prefer it to Punjab 11 for eating purposes. I made a preliminary milling test last year and the several expert millers concerned preferred it to either Punjab 11 or Pusa 12.

Chemical analysis made by the Agricultural Chemist, Punjab, also showed it to contain more nitrogen than either of the above mentioned two wheats.

This wheat is now being much sought after by farmers, and it is spreading rapidly in some places without any help from Government at all. I take this as some evidence that the case is sound, for I have never found farmers anxious to get a bad type.

Preliminary tests of later found wheats indicate that some of them are still better. A survey of the wheat crop in the Muzaffargarh District was carried out in 1917-18 and a number of new types were found and added to the above lot. A good deal of information regarding the wheat crop, including that concerning the Ear-cockle disease referred to later in this report, was collected.

Crosses.

Over 120 selected crosses were under trial this year. Most of these have given very good results. For example cross No. 3, an amber moderately hard grained bearded wheat with strong straw and which does not shed its grains easily gave an outturn of 35 maunds and 30 seers per acre on a 1/4 acre plot while Punjab 11 alongside of it on a similar plot gave 33 maunds and 20 seers.

Incidently I may remark that the milling tests made last year have greatly strengthened my position as regards crossing work, by making more clear the factors affecting milling profits and the values of these factors. A number of types were crossed last year in the light of this and of the results from our plot tests.

Australian wheats.

Seven Australian wheats were grown on small plots for crossing and demonstrating purposes.

Barleys.

Work on barleys is proceeding on the same lines as on cotton and wheats. Some of the promising types have been tried by the Agricultural Sections at Hansi and Lyallpur. At Hansi our No. 2 has done better than the local barley for the past two years and a few other types seem to compare well with the local type. The results of experiments with these varieties at the Lyallpur Agricultural Farm seem to have been greatly upset by the attack of white ants and cannot be taken into account yet.

Grams.

Work on grams is proceeding on similar lines. Some of the promising types have been tried by the Agricultural Sections at Hansi, Gurdaspur, Sargodha and Lyallpur. At the Lyallpur Agricultural Farm our types Nos. 7 and 17 have done much better than the local grams. At Gurdaspur types Nos. 15 and 17 have done better than local grams. At other places the results do not seem at all reliable for one reason or another.

Potatoes.

Scotch potatoes continue to give good results in the Simla Hills. (Detailed Report already submitted to the Director of Agriculture, Punjab.)

These potatoes have been for several years back continuously yielding Rs. 150 to Rs. 180 per acre more than the desi variety grown in the same field.

Three of the best Scotch varieties, *i. e.*, Nos. 3, 17 and 18 were tried this year for the first time at Sialkot. Nos. 3 and 18 yielded much better than the desi variety (Gola) which was grown alongside of them. The experiments will be continued.

The demand for seed-potatoes of our Scotch varieties has been especially keen among farmers round our experimental fields. It is increasing yearly, and is far greater than we can supply. These experiments have been very interesting in showing as how keen an interest farmers take in the results got from growing new varieties of crop interstripped with local ones in their own lands. This is obviously a very useful method of introducing improved types to a locality. We have found farmers very astute in their judgment as to which varieties are best and indeed they have been keen to get the best ones before we ourselves were quite ready to let them have them.

The potato crop is rapidly gaining in favour with Indians as an article of diet, and I feel sure that the time is not far distant when the crop will be a very important one to the Province. Cultivators in the plains will always have to go annually, or almost so, to a colder climate for fresh vigorous seed-tubers and the Himalayas are obviously where these fresh tubers should be found. In the Hills in turn the vigour of the crop will have to be kept up by breeding new varieties from true-seeds. This work has already been started by us, and we have now a working man as potato supervisor stationed in the Simla Hills to help with the work.

Date Palms.

It is now clear that Arabian Dates of a very much better quality than the local dates can be grown in the date growing tracts of the Punjab. The best Punjab Arabian fruits, cured and packed in cardboard boxes for dessert purposes are eagerly sought after at Re. 0-8-0 per pound and we could sell large quantities of uncured fruits fresh from the trees, wholesale in the local bazar at Re. 0-2-0 per pound. This is about equal to Re. 0-4-0 per pound for cured and packed fruits. The great mass of the local dates do not fetch more than Re. 0-0-6 per pound.

Our work shows that dates could be grown practically all over the plains of the Panjab were it not for the rains in the fruit ripening time rotting the fruits. As the fruits grow in large bunches we hope to overcome this difficulty by bagging them in water-proof bags. We are experimenting on this point.

The most serious disease to which the Date Palm is subject here is red-weevil (Rhynchophorus ferrugineus Olive). It bores into the tree trunks and kills them. We have dealt successfully with attacks of these weevils on our young trees and we are experimenting with methods of dealing with adult trees. We have a large number of requests for suckers from local Date-growers and we are now starting a date farm of 18 acres at Muzaffargarh. An assistant has been placed there recently. The war has prevented us from getting young trees from Mesopotamia for some years, but we hope to get some soon now.

The book on the Date Palm and its Cultivation in the Punjab which we have brought out seems to have met a felt want

Drugs.

An attempt is being made to look into what drug plants are growing in the Punjab and the possibilities of extending the drug trade in the Province. A scheme of work has been drawn out and some preliminary investigations have been made with the help of an assistant deputed for six months to help with the work.

Other Crops.

Work on other crops, *viz.*, maize, oats, rapes, etc., was attended to as far as time permitted.

Ear-cockle Disease (Tylenchus scandens) in wheat.

During the recent survey of the wheat crop in Muzaffargarh District evidence collected indicated that the disease was doing damage at a rate of over 2¼ lakhs of rupees per annum in that district alone. In past years we have dealt successfully with a number of cases in which the disease was doing ruinous damage, and we believe we can deal successfully

with more. Experience shows however that the work must be carried on under trained supervision.

A note on the subject is in the press.

MISCELLANEOUS.

I am glad to state that since the private paths in my Experimental Area have been closed, and it has been understood that I may turn out all from my Experimental Area except those people I approve of being there, there has been no visible destruction to experiments which was so very common before. This is the first year, for example, that we have been able to get any results from the date trees along these road sides. The difficulties of assistants whom I hold responsible for the experiments on the various crops in that area have been greatly reduced.

Finally I wish to express my appreciation of the work done by the whole of my staff. They have worked hard for the Department throughout the year and most loyally in the interests of Government in the difficult days of April last.

D. MILNE,

Economic Botanist to Government, Punjab,

Lyallpur.

Statement A.

COTTON OUTTURN ON NEW AREA (SQUARE No. 31).

No. of plot and square.	Area in acres.	Percentage of germination.	Name and number of cotton variety.	Actual outturn.			Outturn per acre.			Percentage of fibre to unginned cotton.	Length of fibre in inches.	Remarks.
				Maunds.	Seers.	Chattaks.	Maunds.	Seers.	Chattaks.			
31 F	½	85	124 Roseum	7	23	4	15	6	8	36	·6	A portion of the plot on the southern side is hard.
	½	90	286F	7	36	12	15	33	8	29	1·1	10 Marlas blank.
	½	75	132 Roseum	7	26	10	15	13	4	36	·6	½ part of the plot blank. Germination of the rest regular.
	½	80	285F	7	30	8	15	21	0	32	1·1	½ crop very poor on account of hard land. A portion destroyed by root-rot.
31	½	56	286F	5	35	0	11	30	0	29	1·1	Soil of this plot is light sandy.
29 31	½	95	124 Roseum	7	1	0	14	2	0	36	·6	Ditto ditto.
	½	96	285F	6	0	2	12	0	4	32	1·1	Light sandy soil.
	½	75	132 Roseum	4	18	4	8	36	8	36	·6	First sown crop did not germinate, 2nd sowing done very late therefore allowance must be made.
11 31	½	90	285F	5	24	14	11	9	12	32	1·1	Light sandy soil, small portion about 10 marlas average land.
	½	98	27 Sanguineum	7	10	14	14	21	12	36	·7	The soil of this plot is light sandy.
	½	98	286F	5	27	0	11	14	0	29	1·1	Ditto ditto.
	½	95	124 Roseum	8	12	3	16	24	6	36	·6	Ditto ditto.
12 31	½	100	124 Roseum	8	29	8	17	19	0	36	·6	About ⅓ of the soil of this plot is very hard. It was manured with city refuse some years ago.
	½	100	286F	9	1	7	18	2	14	29	1·1	Ditto ditto ditto.
	½	98	132 Roseum	9	11	4	18	22	8	36	·6	⅓ of the soil very hard, the rest medium, while plot manured many years ago.
	½	95	285F	10	25	0	21	10	0	32	1·1	⅓ of the soil very hard, rest medium, manured many years ago.

Statement B.

COTTON OUTTURN ON OLD AREA (SQUARE No. 46).

No. of plot and square.	Area in acres.	Percentage of germination.	Name and number of cotton variety.	Actual outturn of kapas.			Outturn of kapas per acre.			Percentage of fibre to unginned cotton.	Length of fibre in inches.	Remarks.
				Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
20A	$\frac{5}{121}$	92	280F. American selection ...	0	34	6	20	24	0	29·30	1·1	Grown on trenched land alongside of a water channel.
,,	$\frac{5}{363}$	85	124G. Sanguineum ...	0	13	3	23	33	0	33	·6	Ditto ditto.
,,	$\frac{15}{726}$	99	40G. Neglectum Roseum ...	2	24	1	12	8	0	34	·6	
,,	,,	74	72F. American selection ...	2	7	0	10	7	0	About 32	1·0	About ¼ of the crop was destroyed by root-rot.
20B	$\frac{5}{121}$	97	161A.F. Ditto. ...	0	28	12	17	30	0	30	1·0	Grown on trenched land.
,,	$\frac{5}{363}$	98	124G. Sanguineum ...	0	17	8	31	30	0	33	·6	Ditto.
,,	$\frac{15}{726}$	95	161A.F.	2	4	0	9	32	0	30	1 0	Poor soil.
,,	$\frac{70}{363}$	95	26 Indian	1	9	2	6	6	0	29	·7	Ditto.
20C	$\frac{5}{121}$	80	288F. American selection ...	0	18	5	11	7	0	30·5	1·1	Land trenched but extremely sandy.
20D	,,	95	276F. Punjab Narma ...	0	20	0	12	4	0	33	·9	Ditto.
21C	,,	98	275F. II Ditto ...	0	33	2	19	34	8	33	·9	Land good.
,,	$\frac{165}{726}$	82	Ditto ...	2	4	5	9	34	0	33	·9	Half the land poor and the remaining half good.
,,	,,	97	21G. Sanguineum ...	2	3	11	9	6	0	34	·6	Poor land.
21D	$\frac{195}{726}$	95	132G. Neglectum ...	3	3	9	11	18	0	36	·6	Fair land.
,,	$\frac{165}{726}$	99	280F. American selection ...	3	14	6	15	22	0	30	1·1	Land of average quality.
21F	,,	97	281F. Ditto ...	2	32	8	13	5	0	29	1·0	⅓ of the crop of the western side was damaged by stagnant water.
,,	,,	100	38G. Indicum ...	2	14	1	11	0	0	29	·55	Land of average quality.
										29·30	1·1	Ditto and portion of the crop destroyed by root-rot.
22E	$\frac{1}{6}$	75	280F. American selection early ...	1	12	6	11	32	0			
,,	,,	50	22 G. Neglectum var. Roseum ...	1	8	9	10	37	0	36	·6	Half the crop destroyed by root-rot.
22D	,,	95	T. Mollisoni	1	17	4	12	35	0	37	·6	A portion of crop on the eastern side destroyed by root-rot.
23D	$\frac{1}{6}$		288 F. American selection ...	1	30	4	10	21	8	30·5	1·1	Grown on poor soil, much damaged by root-rot.

N.B.—Soil of square 46 is very poor. Many varieties of Desi as well as of American cotton have yielded poor outturn.

ANNEXURE I.

Valuation and report by Messrs. Tata Sons and Co., Bombay, dated the 14th July 1919, upon 38 samples of cotton submitted by the Economic Botanist to Government, Punjab, Lyallpur.

Basis.	
Scind American	Rs. 625
Middling spot in Liverpool	20 *d.* per lbs.
	Rs.
Fine Navsari	670
Fine Surat	650
Fine Broach	610 (real quality).
Cambodia	650
F. Akola	540
F. Bengal	470

Serial No. 1.—72F, Dharwar American. It is good long stapled strong fibred silky cotton. Good for 44*s*. It is a bit better than Navsari and may be valued at Rs. 685.

Serial No. 2—126F. This is shorter in staple than the serial No. 1 and much inferior to it It also resembles Scind American and may be valued at Rs. 625 good for 24*s*.

Serial Nos 3-4—161 AF. On comparison, we find that both are almost alike, though No. 4 is a bit superior in length to No. 3. Both resemble Navsari and are good for 40*s*. No. 3 may be valued at Rs. 670 and No 4 at Rs. 675.

Serial No. 5.—271F. This resembles Surat in smoothness, fineness and silkiness. It may be valued at Rs. 650 good for 30*s*.

Serial Nos. 6-7—275F II. Out of these two, No 6 is a bit longer in staple than No. 7. Both resemble Scind American. No. 6 may be valued at Rs. 635 and No. 7 at Rs. 630. Both are good for 24*s*. Both are bulky and have not the softness of Surat.

Serial Nos. 8—8 A.—276F. I.
276F. On comparison No. 8 A. is superior to No. 8 in length of staple. Both are fine, silky and have a soft feel and they are far superior to Nos. 6 and 7 of the same type. They resemble Navsari. No. 8 A may be valued at Rs. 675 and No. 8 at Rs. 665. Both are good for 40*s*.

Serial Nos. 8-9-10-11-12-13-14-15-16-16 A.—
280F.
281F.
285F.
285F.
286F.
287F.
286F.
288F.
288F.
We have examined these 9 samples and place them in order of merit as under, specially as regards length of staple. All are fine, silky, soft and long stapled cotton. We place No. 12 at the top and divide the remaining eight into three groups. Samples Nos. 13-14 and 16 A stand under the first group. Under the second come Nos. 9, 10 and 11 and under the third stand Nos. 15 and 16. No. 12 is far better than American middling and may be valued at Rs. 850 good for 50*s*. Group No. 1 is somewhat shorter in staple than No. 2 and may be valued at Rs. 800 and they are also good for 46*s*. Group No. 2 may be valued at Rs. 750 and is good for 44*s*. Group No. 3 may be valued at Rs. 700 and is good for 36*s*.

Serial Nos. 19-20-21-22-23.—289F.
290F.
291F.
292F.
293F.
These five may be grouped under the 3 heads as under :—

No 19 stands first.

Nos. 22-23 are almost equal and stand next to No. 19.

Nos. 20-21 stand last.

No. 19 resembles long stapled African cotton and is good for 60*s*. It may be valued at Rs. 900. Nos. 22 and 23 may be valued at Rs. 780 and good for 44*s*. Nos. 20 and 21 may be valued at Rs. 770 and good for 42*s*.

Serial Nos. 24-24 A-24 B—Cross No. I. A. Of these 3, No. 24 is superior to Nos. 24A and 24B both in length and strength of fibre. 24A and 24B are very weak in fibre. No. 24 is almost equal to Navsari but is weak in fibre. We value it at Rs. 660 good for 32*s*. Nos. 24A and 24B may be valued at Rs. 615 good for 20*s*.

This resembles Navsari in all respects. It may be valued at Rs. 680 and good for 36*s*.

Serial No. 25.—168 Dharwar American.

N. B.—This year the crop of Broach, Surat and Navsari is entirely spoiled and the staple owing to want of moisture is very short. Hence the values that we have quoted above for the Lyallpur American style of cotton should not, therefore, be compared with those of Surat and Navsari as ordinarily ruling in the market but the cottons have been valued on their merits.

Desi Cotton.

We have examined these 6 samples and find that No. 26 has some semblance of staple in it. All the others are almost alike except No. 30 which is harsh in feel, and have no staple. No. 26 is good for 10*s*, and may be valued at Rs. 480. All the rest except No. 30 may be valued at Rs. 450 and good for 6*s*. No. 30 may be valued at Rs. 440 and good for 6*s*.

Serial Nos. 26-27-28-29-30-31.—27G.
124G.N.
26G.
76A.G.
38G.
L.G.I.

Experiments in Banking and Milling tests by Mr. D. Milne, Economic Botanist.

Two years ago Mr. Ball, Manager of the Delhi Flour Mills, Delhi, in reply to questions of mine informed me that a reliable milling test of a wheat in a Commerical Mill would not be got under a 2 hours run of the machinery, and that as the Delhi Flour Milling Company's "A" mill was grinding at the rate of about 80 maunds per hour, 200 maunds was the least quantity of the grain of any type of wheat which would give us complete and reliable information on ordinary milling points there. He also said that certain information could be got from tests of 20 maunds and even 2½ maunds (one bag). He said that separate lots would have to be provided for obtaining information on special points like comparative capacity for yielding semolina, etc.

Mr. Grant Govan, Managing Director of the Delhi Flour Mills, very kindly agreed that Mr. Ball should give us any help in his power as regards milling tests and accordingly arrangements were made to provide grain for tests in the Delhi Flour Mills.

The following harvest (1917) was so wet, however, that a very large proportion of the grain was obviously spoiled, and it was felt that milling tests would not give ordinary results, therefore, no milling tests were made in 1917.

(2) *Types of wheat and amounts of grain milled.*—The harvesting season of 1918 was more normal and in the end of September of that year 200 maunds or over of the grains of types 8-A, 8-B, Punjab 11, Punjab 14, Punjab 17, and Pusa 12, and smaller amounts of types 9-C, 17-B, 20-C and crosses Nos. 2 and 3 were collected in the Delhi Flour Mills. The whole consignment totalled 1,500 maunds and 15 seers. For exact amounts of grain of each type collected and details of the places from which we got the grains, see statement "A" appended.

(3) *Change of control of the mills.*—Between the time that these tests were originally arranged for, and the time they were carried out, the Delhi Flour Mills had volunteered to hand over their mills to Government control, and this had been accepted by Government.

However, Major Gwynn, Deputy Controller of Contracts (Wheat Products), very kindly not only allowed the work to proceed but gave us most valuable assistance in many ways.

(4) *Colour of skin and general textures of grains of the types sent to the mill.*—The colours of the skins and the general textures of the grains of the types dealt with were as follows :—

	Type.		*Colour of skin.*		*General hardness of grains.*
1.	9-C	...	Amber	...	Hard.
2.	8-B	...	Do.	...	Do.
3.	8-A	...	Do.	...	Moderately hard.
4.	Punjab 17	...	Do.	...	Do. do.
5.	17-B	...	Deep red	...	Do. do.
6.	Cross 3	...	Light amber	...	Do. do.
7.	Cross 2	...	Ditto	...	Do. do.
8.	20-C	...	Ditto	...	Do. do.
9.	Punjab 14	...	Red	...	Do. soft.
10.	Punjab 11	...	White	...	Do. do.
11.	Pusa 12	...	Do.	...	Soft.

(5) *Order of merit from a milling point of view as judged from the hand samples.*—Hand samples of the grains were examined by Major Gwynn, Mr. G. A. Ball, Manager of the Delhi Flour Mills, and Mr. C. R. Goodwin, Manager of the Ganesh Flour Mills, Delhi—all expert millers. The following is the order from a milling point of view in which the samples were placed by these gentlemen :—

ORDER OF MERIT AS ARRANGED BY

Major Gwynn and Mr. Ball.		*Mr. Goodwin.*
1.	8-A	1. 8-B.
2.	8-B	2. Punjab 17.
3.	Punjab 17	3. 8-A.
4.	9-C	4. Cross 3.
5.	20-C	5. 9-C.
6.	Punjab 11	6. 20-C.
7.	17-B	7. Punjab 11.
8.	Cross 2	8. Pusa 12.
9.	Pusa 12	9. Cross 2.
10.	Cross 3	
11.	Punjab 14	(1) 17-B. (2) Punjab 14.

It will be noticed that the places given to any one wheat in the two columns are not very different except in the case of Cross No. 3. The grains of this wheat had black ends due to rains at the ripening time and the difference in position in this case is due to the fact that whereas Major Gwynn and Mr. Ball judged the grains simply as they actually appeared before them, Mr. Goodwin allowed for the black points as an accidental occurrence, *i.e.*, not an inherent quality, and placed the grain accordingly. Major Gwynn and Mr. Ball quite agreed to this higher position in the scale for Cross No. 3 provided that the black ends had been absent. Mr. Goodwin judged the red wheats separately, therefore, 17-B and Punjab 14 are together in his lot.

Regarding these wheats all the judges were agreed that they were by a long way the finest they had seen in India from a milling point of view.

(6) *A few remarks regarding the value of textures, colour and size of grains.*—In this case the grains were classified entirely from a milling point of view. Millers prefer moderately hard wheats to soft wheats, one reason for this being that the hard wheats take up more water in the process of conditioning them correctly for the mills and consequently yield more weight of saleable products at the other end of the mill. This difference may give a substantial profit to millers even in Indian Mills, and the profit is greatly accentuated in the case of home millers purchasing Punjab wheats as the heavy cost of carriage adds to the value of the saving made on account of water added there. In 1910 it was estimated that it cost 5 shillings and 3 pence per quarter (492 lbs.) to carry wheat from Amritsar to Karachi and 3 shillings and 10 pence per quarter to carry it from Karachi to London. This amounts to a total of 9 shillings and 1 penny per quarter or Re. 1-2-0 per maund for wheats delivered in London, without cost of insurance, etc.—(*vide* pages 9 and 13 of memorandum on Indian wheats for the British market, bulletin No. 20 of the Agricultural Research Institute, Pusa, dated September 1910), and with the present high prices of grain and freights the gains for extra water that could be added would be far greater.

Again, in milling wheats, millers' aim at breaking the grain kernels into semolina and getting the offals (Bran and Pollards) separated off before reducing the semolina to flour. This is done to avoid contamination of the flour with offal particles. As larger proportions of the kernels of soft wheats than of hard wheats break up into flour before the offals can be separated, millers prefer hard wheats.

Also hard wheats can usually be milled to yield a thinner bran, more free from flour than soft wheats. Consequently hard wheats can usually be reckoned on to yield a larger percentage of flour—the most valuable product of the milling process—from their kernels than soft wheats.

A whiter flour can often be made from soft, than from hard wheats but the flour of the highest feeding value usually comes from the hard wheats. Soft wheat grains are also more liable to weevil attack in the store than hard wheats, therefore, soft wheats have a number of disadvantages.

Regarding the value of colour of skin of the grain, red is a disadvantage to the miller as although the kernel of a red wheat may be as white as that of a white skinned wheat, or whiter (see paragraph 15 of this report), any fine particles of red skin which have not been separated from the flour discolour it more than similar particles from a white skin. It is, therefore, more difficult for a miller aiming chiefly at flour manufacture to separate the flour as completely from the bran in the case of a red wheat as in the case of a white wheat and still keep the colour of the flour up to the standard. This is most accentuated when the red wheats are soft grained. The skins can be extremely neatly and cleanly removed from hard wheat grains as these break nicely into suji (semolina) particles instead of flour on the break machines as a rule.

In the case of the miller who makes both flour and "ata," more flour has to be left in the "ata" from a red, than from a white wheat to get the standard of colour in the "ata." Mr. Ball informs me that 4 per cent. more flour (straight run) can be taken out of white wheat than out of red wheat and still keep the "ata" up to the market standard. He also informs me that, in Great Britian and Ireland, bran from white wheat will fetch from 25 per cent. to 40 per cent. more money than bran from red wheat. The price of bran in January 1919 was £14-10 per ton (*vide* "Milling" market report, dated January 18th, 1919). This, however, is an abnormally high price owing to Government control. The preference may be due to mere prejudice, but may not be so, if the white bran was made from soft grained, and the red bran from hard grained wheats. In that case we would expect the bran from the hard wheat to have less of the grain kernel with it, and consequently to be of less feeding value. Perhaps the bias, or the origin of the bias, may be due to this cause. It would be very interesting to see chemical analyses of the brans; to hear more particulars regarding the textures of the grains, etc., in such cases.

I am also informed by the same authority that in Britian, Pollards from red wheats sell at less money than those from white wheats. It would be interesting to look further into this in the same way. Red skin is not an improvement to a wheat grain from any miller's point of view, however, and may be of very serious disadvantage to him. It may also be mentioned that in purchasing wheats in the Punjab hard reds when mixed with amber wheats are classified as a rule, as amber; if soft reds they are classified as red, and a deduction is made from the price accordingly.

In evolving wheats there are several other points to be kept in mind which the miller judges in the hand sample ; for example the size and shape of the grains. The many and complicated machines now used by millers for cleaning and preparing wheats for their mills, are fitted with scientific exactness to deal with average sized grains from the world's great sources of supply, and as millers would not care to refit their mills to deal with some special sized grains our aim has been to obtain a type of wheat the grains of which are of the correct size. I understand that the grains of 8-A, 8-B and other of these types of wheats above referred to are very satisfactory in this respect.

(7) *Weights of the grains per bushel.*—In many markets wheats are bought at prices according to their weights per bushel, as weight per bushel is considered some indication of quality. The following are the weights per bushel of our wheats, as they arrived at the Delhi Flour Mills and the wheat (Delflo) which the Delhi Flour Mill was grinding at that time. Two weighings were taken of the grains of each type as the work proceeded, and where the weights differed the two weights are given :—

Type.	Weight of uncleaned wheat per bushel in pounds.	Remarks.
8-B	64¾ to 65⅛.	
8-A	64 to 65⅛ ...	The 64 lbs. per bushel grains were not as well developed as the 65⅛ lbs. grains.
Punjab 14	65	
9-C	64¾	
Pusa 12 (2nd lot)	64¼	Very well developed even grains.
17-B	64⅛	
Punjab 17	63¾	
Punjab 11	63¾	
Pusa 12 (1st lot)	63 to 63½	Not as well developed as the grains of the second lot referred to above.
Delflo	61¾ to 62	

60 lbs. is the standard weight of a bushel of wheat in England.

The following are the weights of 6 average samples of Canadian wheats as given by the Department of Trade and Commerce, Winnipeg, Canada, in 1918, *viz.*, 65·5, 64·0, 64·5, 64·5, 64·5, 63·0 lbs. per bushel. Ours compare not badly with this.

(8) *One type per day dealt with.*—As our wheats required special conditioning ; only one wheat conditioning bin could be spared for the work on our wheats, and as any stoppage of the mill would obviously be a very serious loss to the millers, it was only possible to mill one of the types per day.

(9) *Refractions.*—The refractions from our wheats at the mill consisted of weed seeds ; wheat grains which were light, small, broken, etc. ; stones, chaff, dust, except that taken out in the water stream where the grains were being washed for the conditioning bin and skins of grains taken out by the whizzer. Most of these items depended so much on the thoroughness of the cleaning which the grains got before being sent to the mill that the weights of refractions got from each type are of little importance. It may be noted, however, that they ran about 1-2 per cent. of the weight of the consignments sent to the mill, while refractions (excluding barley) in ordinary wheats sent to Indian mills generally amount to 3 to 5 per cent. and as our wheats only got dressing such as any farmer might give his crop, refractions at mills need never reach a higher figure than we got.

(10) *Treatments of the types when being conditioned for the mill.*—These types of wheat being quite new to millers, the treatment required by a type to bring it to the condition as regards moisture to mill most economically was a problem, and the types being very various in texture the problems were just as various. Our effort in this case was, therefore, to give each sort such treatment, as we thought would bring it to the correct state and in the light of the results got to suggest an ideal treatment for future consignments. We now have a record of this sort.

(11) *Comparative amounts of water which the types absorbed in the conditioning process.*—For the reasons given in paragraph 6 above, a point of great importance to a miller in choosing a wheat is the amount of water which it will take up in the process of conditioning it correctly for the mill. This point has been steadily kept in view when evolving our types of wheats and from moisture tests made on the whole grains before being conditioned and again as they entered the first break rollers we have now got a certain amount of data on the point (see Statement B attached).

I also tested the moistures in the brans, sujis and flours of these types as they were being milled (see also Statement B attached) to give us some indication of the proportions in which the weights of the different products were increased by the water added when conditioning the grains ; to show up any over-dampness of the flours, etc.

In this connection, I may mention that Amos in "The Process of Flour Manufacture" gives 17 per cent. as the moisture in flour in medium condition ; Simmons in his "Book of Bread" indicates 12 per cent. as a common figure, while 13·2 per cent. is the moisture in the flours from the Canadian milling tests mentioned in paragraph 7 above. None of our flours are, therefore, over-damp. Statement B shows that the grains of 9-C took up 10·2 per cent. of water when conditioning, but it was rather too damp on the break rollers. It has hard grains, and apparently it had not lain long enough in the conditioning bin to allow the water to soak properly into the kernels. Had it lain there a little longer, it apparently would have carried all the water comfortably, as the moisture in its flour has still to rise a good deal before it could be called over-damp. To be quite within the mark let us assume, however, that it will take up only 9 per cent. of moisture. 8-A absorbed 5·36 per cent. of moisture, but as it was very much under-conditioned it might be expected to take up 7·5 per cent. 8-B took up 5·59 per cent. and was right conditioned for suji (semolina) making, but was rather too dry for flour making. It might be expected to take up 7 per cent. when correct for flour. 17-B took up 5·64 per cent. and might be expected to carry over 6 per cent. Punjab 17 took up 4·78 per cent. and might be expected to take up 6 per cent. or over. Punjab 14 took up 5·53 per cent. and was ideally conditioned.

Punjab 11 took up 3·63 per cent. and might be expected to take up, say 4·5 per cent.

Delflo, which was a consignment of ordinary wheat from the Chenab Colony and consisted of 80 per cent. white grains with the characters of Punjab 11, and 20 per cent. of red grains with the characters of Punjab 14 took up 4·80 per cent. of moisture and was correctly conditioned.

Our first lot of Pusa 12 took up 5·62 per cent. but was much over-conditioned while a second lot which we were able to obtain took up 3·01 per cent. and was ideally conditioned. The moisture absorbing powers of these types, therefore, range from 3 to over 9 per cent. Consequently, the profits of the millers in England or even here would be materially affected by the type given to them (see also paragraph 12 below).

(12) *Weights of products got from the mill.*—Our intention when arranging for 200 maund lots of the grains of types to be grown for these tests was, among other things—

(*a*) to take weighments of the total amounts of products got from each type in the mills, and

(*b*) also to get an idea of the best possible outturns of the different products that could be got from each type.

Regarding the former point, we had to remember that products from a wheat which has passed through the first break machinery only come out of some of the other machines in the mill nearly half an hour later, and that millers could not afford part of the machinery to be stopped while these remaining machines were dealing with the stock; also that a certain amount of the stock remains about the angles, etc., of the machines even after the delivery spouts have ceased to flow and that millers could not afford to stop the mill to brush out all machines before starting on our types and again after each type was milled as each cleaning operation would occupy some hours. The intended method of getting the data was to discover the time which elapsed between the opening of the feed-spout to the mill and the moment when each product began to appear in reasonable quantity at the spout where it is collected; to start collection after that lapse of time from the opening of the feed and to continue collecting it for a similar period after the feed was closed.

In the case of the bran, which is practically all got off at one machine, the change from the bran of one type of wheat entering the mill to that from another wheat takes place with comparative suddenness, and the timings can be arranged so as to give very accurate results even from moderately small quantities of wheat, but in the case of a product like straight run flour which is got in different proportions from machinery stretching all the way from the first break to the tail end of the mill, the transition from the product of one wheat to that of another is a gradual one lasting nearly half an hour, and as different textures of wheats will give different proportions of their flours at different points in the mill, the moment to begin collection is more difficult to choose. If the feed to the mill continues the same before, during, and after the milling of the type under consideration, and the machinery is adjusted to deliver about the same proportions of the flour at the same points of the mill an approximately correct comparison of the total weights of flour got from the different types should be got when the mill has run for some hours on each lot being tested.

Unfortunately for us, however, the rate of the feed of the mills after being given over to Government, had to be increased about 70 per cent. owing to urgent Government requirements, therefore, our 200 maund lots of wheat represented only about 1½ instead of 2½ hours runs of the mill and consequently any errors in total weights got would be in the inverse proportions of these times. One and a half hours was not sufficient to give us accurate results, but as the

total weight of products which come out of a good mill will be the weight of wheat grains put into the mill, plus the amount of water it absorbed during the conditioning process, minus a loss due to evaporation of moisture in the milling machinery and reckoned at about 1·5 per cent. on properly conditioned wheats by British millers, I tried to get some measure of the differences in total outturns which these wheats will give when milled, by discovering the amounts of miosture taken up by each type during the conditioning process (see paragraph 11 above).

The moisture figures in the Brans, Sujis and Flours of the different types—unfortunately I had not the time to get the moisture in the 'ata' as well—indicate however, that we cannot reckon on an evaporation loss of 1·5 per cent. from each type in the present trials, and a repeat trial with the types properly conditioned is necessary.

(13) Regarding point (*b*) of the previous paragraph, the dressing machines of the mill were adjusted for Government purposes to turn out—

40 per cent. flour

40 — 45 per cent. 'ata' (Pollards with a large percentage of flour).

15 — 20 per cent. bran,

and as re-adjustments to yield other proportions would have involved many days of labour and stoppage of the mill, our wheats were milled with the machinery adjusted in that way. Common wheats here yield something like 68 to 70 per cent. of fine flour, 15 to 20 per cent. bran and the remainder sharps (Pollards), therefore, it would have been easier to give an opinion regarding the best possible outturns to be expected from these wheats had the mill been working nearer the maximum flour limits. However, after milling the lots with the mill working on the basis that it was working on, Mr. Ball thinks that the possible outturns of fine flour from these types may be approximately as follows; judged from a pre-war point of view :—

Estimate of flour yields—

Type.	
8-B	Up to 75 per cent.
8-A	
Punjab 17	73 or 74 per cent.
9-C	72 per cent.
17-B	70 per cent.
Punjab 11	
Pusa 12	68 to 70 per cent.
Punjab 14	

Brans.—As regards bran, the information to hand shows that 8-A and 8-B will yield a minimum proportion while Punjab 14 and Pusa 12 will yield the highest proportions. Punjab 14 is a moderately soft red wheat, therefore, this would agree with what is usually found in practice (see paragraph 6 of this report).

The following is an estimation of the order in which the types stand with regard to yield of bran :—

8-B, 9-C } Will yield a minimum of bran, say 13 per cent.

Punjab 17.

8-A.

17-B.

Punjab 11.

Pusa 12.

Punjab 14.—Will yield a maximum of bran, say 18 per cent.

An interesting point in this connection is the report that some Punjab growers of Pusa 12 who had milled their wheats in their own stone mills expressed the opinion that Pusa 12 gives a very high proportion of bran. The exactness with which a miller can separate the kernel from the bran is a matter of importance to him as the market value of bran is very low in comparison with that of other products. For example in the north of India—

Flour usually sells at about Re. 1-8-0 per maund over the price of wheat,

Ata „ „ „ „ Re. 0-8-0 ditto ditto.

While Bran „ „ „ half the price of wheat.

The percentage of ata or of sharps yielded by a type of wheat will be practically the difference between 100 and the sum of the percentages of the flour and bran.

Regarding Sujis (*Semolina*).—Samples of suji (semolina) were collected from the mill as the work proceeded. As regards merit for marketing in that form they have been arranged in the following order :—

8-A, 8-B } These make an ideal suji.

Punjab 17.

9-C.

17-B.

Punjab 11.

Punjab 14, Pusa 12 } Unfit for making suji, because the grains are too soft and the suji is a dead white colour.

The ideal suji has a yellowish tinge and is free of white specks.

To get an exact record of the maximum proportions of suji which these wheats will yield separate millings would have to be made, but judging from their behaviours in the mill in the present case, something like the following is expected :—

8-A, 8-B, 9-C } Will yield a maximum of over 30 per cent. marketable suji.

17-B, Punjab 17 } Will yield 15 to 20 per cent. marketable suji.

Punjab 11.—Will yield 10-15 per cent. marketable suji.

Punjab 14, Pusa 12 } Absolutely unfit for making marketable suji.

The percentages of suji that could be got from these types of wheats may, therefore be taken to range from o to 30 per cent.

Mr. Ball informs me that the market value of suji (semolina) in India is always higher than that of ordinary flour and is usually on a level with superfine flour or even higher.

As already indicated in paragraph 6 of this report flour millers much prefer a wheat which breaks neatly into suji particles on the break rollers, as in that case they can separate the bran from the stock most economically, *i.e.*, with a minimum of kernel attached. The best and strongest flour is made from suji particles.

(14) *Colour of flour.*—As regards colour in the hand sample, the flours have been placed in the following order :—

Pusa 12 (*1st lot*) had a very white colour; 8-B and 8-A have a much darker colour. The others were intermediate.

For any particular type of wheat the more water added—up to a certain limit—during the conditioning process, the whiter will the resulting flour be ; and as 8-A, Punjab 17, and 8-B were much under-conditioned when milled this must be taken into account. In this connection it was interesting to note quite a distinct difference in colour between the flours of the first and second lots of Pusa 12 ; the first lot being the whiter.

Mr. Ball says that had 8-A and 8-B been fully conditioned the colours of the flours from them would have been much improved. Wheats under-conditioned have more bran powder in them and are therefore more brown. Hard particles of endosperm are less broken and therefore appear more coloured. The finer the division and the more air there is trapped between the component particles, the whiter will the substance appear to the eye. An example of this is seen in the comparatively white foam on a black beer. 8-A has, what has been described by several people as a desirable yellowish tinge, and Mr. Ball thinks that the colour of the loaf made from its flour milled from properly conditioned grain, will probably be the best of all.

Regarding colour of flour, Simmons, the well-known authority on bread baking in Britain, says on page 83 of his "Book of Bread" "Yellow represents quality" and millers that I have talked to, generally agreed with this.

(15) *Pekar's test of colours of flours.*—Pekar's test of the colours of flours consists of placing small samples of flour side by side on a piece of board, smoothing the surfaces of the samples with a piece of glass ; dipping the board loaded with the flour under water and judging the colours after the flours have dried in ordinary atmospheric conditions. When flours from properly conditioned wheats are treated in this way, some idea is got of the colours that they will give after being baked. Indeed some indication of the colour which will be got after baking can be predicted almost immediately after the flours are wetted.

The following is the order in which the flours were placed as regards colour after being dipped in water, and dried as described above :—

Pusa 12 (1st lot).
Pusa 12 (2nd lot).
8-A.
Punjab 17.
Punjab 14.
9-C.
Punjab 11.
17-B.
8-B.

The colours of the flours from the two lots of Pusa 12 were still distinctly different ; that of the first lot being more creamy, while that of the second lot was a more chalky-white. The colour of 8-A improved tremendously after the above treatment. It became a bright creamy yellowish tinge, and Mr. Ball and his assistant, Mr. Khoshla, who is a medalist in flour milling technology in Britain, state that some buyers would prefer its colour to those of the Pusa 12 samples. The colour of 8-B still remained much the darkest of the lot.

BAKING RESULTS.

(16) Samples of the flours were baked by the Baker for the Military in the Fort, Delhi, through the kindness of Lieutenant Hill, Supply and Transport Corps, who was in charge of the bakery.

The following data were got :—

Type.	*Total weights of freshly baked loaves got per* 100 *pounds of flour used.*
8-B	144·8 lbs.
Punjab 11	144·2 „
17-B	143·5 „
8-A	142·9 „
Punjab 17	141·3 „
9-C	140·5 „
Punjab 14	137·9 „
Pusa 12 (1st lot)	136·8 „
Pusa 12 (2nd lot)	136·7 „

The actual amount of flour of each type used in this case was about 80 lbs.

(17) *Sizes of the loaves.*—Arranged in order of size of loaves, the types stood as follows :—

(1) 9-C.
(2) Pusa 12 (1st lot).
(3) 17-B.
(4) Punjab 17.
(5) 8-B.
(6) Punjab 14.
(7) Pusa 12 (2nd lot).
(8) 8-A
(9) Punjab 11
} These seemed badly proved.

The amount of proving greatly affects the size of loaves.

(18) *Colour of crust and crumb.*—As regards colour of crust and crumb, they stood as follows :—

8-B.
8-A.
9-C.
17-B.
Punjab 17.
Punjab 14.
Punjab 11.
Pusa 12 (1st lot)
Pusa 12 (2nd lot)
} The crumbs of these two lots had a yellowish tinge and the loaves of the 2nd lot were smaller and worse coloured than those of the 1st lot.

Such were the results got, but the flours from the different types were of widely different characters and from the preliminary baking done they obviously required widely different treatments to get the best results out of them. We had far too little time to discover the best treatment for the flour of each type and to confirm results by a sufficient number of repeat tests. By the time the baking was done, the flours had also lain too long in the store to give reliable results in any case. Careful baking tests should be taken in hand after this harvest. We will probably get them best done at the School of Bakery of the Supply and Transport Corps, Rawalpindi, or other such School.

(19) *Chemical analysis of the grains.*—The Agricultural Chemist to Government, Punjab, here, kindly analysed the grains of a number of these types for me in June 1917. The analyses are as follows :—

Name of variety.	Moisture per cent. (24 hours in steam oven).	Nitrogen per cent.	Starch per cent.	Indigestible fibre per cent.	Ash per cent.	Soluble Carbo-hydrates (as Glucose) per cent.
8-A	8·36	2·50	66·0	2·09	1·74	3·38
8-B	8·38	2·78	67·1	2·55	1·65	3·05
17-B	8·51	2·35	68·0	1·93	1·52	3·36
9-C	8·80	2·15	68·5	2·14	1·46	3·55
Punjab 17	8·07	2·23	70·1	2·13	1·54	4·05
Punjab 11	8·16	1·86	71·6	2·53	1·47	3·70
Pusa 12	8·33	2·08	68·5	2·21	1·72	4·06

A comparison of the above table with the preliminary baking results got give rise in my mind to questions which I wish to look into as early as possible. The points will be reported on in due course.

(20) *Summary of results.*—These milling tests have confirmed my opinion that we should prefer moderately hard to soft wheats ; white or amber to red wheats ; hard red to soft red wheats, etc. They also show that 8-A and 8-B are more profitable to millers than Punjab 11 and Pusa 12.

The baking results indicate that the flours from 8-A, 8-B and others yield as good coloured loaves as the flour from Pusa 12 does.

The size of the loaf got from 8-A was smaller than that from Pusa 12 and others. The possible causes of this are being looked into and promise some interesting results.

(21) *Future work.*—Proposals for future work will be put up in a separate reference.

(22) *Acknowledgements.*—I may mention that—

(*i*) Major Gwynn, Deputy Controller of Military Contracts (Wheat Products), is a first class Honours man in Milling Technology in the City and Guilds Examinations, and has over 25 years' experience in Flour milling in England, Ireland and India ;

(*ii*) Mr. G. A. Ball, Manager, Delhi Flour Mills, has had 14 years' milling experience in Ireland and England, and 17 years' experience as Mill Manager in large mills in India including Bombay, United Provinces and the Punjab.

(*iii*) Mr. Goodwin, Manager of the Ganesh Flour Mills, Delhi, has had about 10 years' milling experience in up-to-date mills in Worcestershire, England and 22 years' experience in the north of India.

Therefore, when I put my questions to these gentlemen, I felt that their replies were based on wide and long practical experience of milling both in Britain and in India They were ever ready to assist me and we are deeply indebted to them. We have also to thank Lieutenant Hill, Supply and Transport Corps, for so very kindly placing his baking staff and bakery at our service.

The problem that I set myself was to discover the characters of wheats that are of importance to Millers and Bakers and the relative economic values of these characters. This problem cannot be solved at a single step, but I feel that I am in a very much stronger position as regards the lines I have worked on, for the improvement of wheats in the Province, than I was, before I conducted these trials and discussed my points with the gentlemen mentioned above.

D. MILNE,

Economic Botanist to Government, Punjab, Lyallpur.

STATEMENT A

Showing the types of wheat milled in the Delhi Flour Mills in September—October 1918, *and places from which the grains were obtained.*

Type No.	Lyallpur Botanical Section.		Lyallpur Agricultural Section.		Sargodha Seed Farm.		Hansi Agricultural Farm.		Gurdaspur Agricultural Farm.		Jullundur.		Chak 192 S. B., Sargodha.		Total amount sent to the Delhi Flour Mills.		Remarks.
	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	
8-A ...	7	20	100	0	...	...	24	30	...	...	...	...	70	14	202	24	
8-B ...	12	0	100	0	...	...	11	0	...	...	...	...	85	17	208	17	
Punjab 11 ...	70	0	135	0	...	...	...	...	...	...	...	...	...	...	205	0	
Punjab 17 ...	...	..	202	5	...	...	...	...	...	...	...	...	...	...	202	5	
Pusa 12 ...	7	0	...	...	...	...	49	20	...	...	200	0	...	...	256	20	
Punjab 14 ...	...	...	...	...	...	...	101	30	101	30	...	...	...	...	203	20	
9-C ...	10	26	20	0	15	0	...	...	...	...	43	0	...	...	88	26	
17-B ...	7	8	35	0	20	0	...	...	41	10	5	0	...	...	108	18	
20-C ...	7	25	...	...	...	...	...	...	...	...	...	...	...	...	7	25	
Cross 2 ...	7	20	...	...	...	...	...	...	...	...	...	...	...	...	7	20	
Cross 3 ..	10	0	...	...	...	...	...	...	...	...	...	...	..	...	10	0	
Total ...	139	19	592	5	35	0	187	0	143	0	248	0	155	31	1,500	15	

STATEMENT B.

Showing the percentages of moisture lost in a steam oven at a heat of about 98° F. from the wheat grains in the unconditioned and condition states and from the products which they gave in the mill ; also showing the percentage of moisture gained during the conditioning process and the proximity of the lots to the ideal condition for milling.

Type No.	Date of milling.	Whole undressed unwashed grains.	Conditioned grains entering first break.	Percentage of moisture absorbed during the conditioning process.	Bran.	Coarse Suji.	Fine Suji.	Straight run Flour.	Remarks.
1	2	3	4	5	6	7	8	9	10
Punjab 17	27th September 1918...	8·09	12·01 13·03	4·78	10·53 11·24	11·13 11·34	11·15 11·22	10·31 10·59	Underconditioned by a long way.
Pusa 12 (1st lot) ...	28th September 1918...	8·37	13·96 14·03	5·62	12·07 12·07 12·14	12·28 12·50	12·27 12·51	10·37 10·52	Overconditioned considerably.
Punjab 11	30th September 1918...	8·40	12·12 11·94	3·63	10·54 10·87	10·91 10·99	10·86 11·13	9·90 10·20	A little underconditioned.
Punjab 14	1st October 1918 ...	7·95	13·41 13·55	5 53	13·05 12·51	12·02 12·08	12·18 12·06	10·78 10·78	Just right conditioned.
8-B	2nd October 1918 ...	7·26	12·87 12 84	5·59	11·28 11·77	11 64 11·63	11·53 11·83	10·59 10·60	Conditioned right for suji, but too little water for commercial flour making.
8-A	3rd October 1918 ...	6·77	12·07 12·19	5·36	11·09 11·14	11·37 11·31	10·99 11·22	10·26 10·52	Under conditioned by a long way. Mr. Ball liked it better than any wheat milled so far.
Delhi Flour Mill ordinary wheat.	7th October 1918 ...	8·09	12·85 12·94	4·80	10·54 10·70 10·41	10·13 10·63 12·33	10·53 10·64 10·60	10·89 10·91 10·98	Correctly conditioned.
17-B	8th October 1918 ...	7·98	13·63 13·61	5·64	12·11 12·17	12·08 12·10	12·43 12·28	10·98 11·08	Not badly conditioned, but could have carried a little more water for commercial purposes.
9-C	10th October 1918 ...	7·27	17·69 17·72	10·43	15·75 16·16	14·45 14·36	13·89 13·97	11·50 11·55	A little too damp on the break rollers.
Ganesh Flour Mill wheat...	...	...	...	...	...	...	...	10·12 10·40	
Pusa 12 (2nd lot) ...	14th October 1918 ...	7·47 7·98	10·74 10·80 10·72	3·01	10·81 10·83	9·92 9·42 9·73 9·65	9·94 9·94	9·70 9·98	Just right conditioned.

Experiments in Agricultural Chemistry by Mr. B. H. Wilsdon, Agricultural Chemist to Government, Punjab.

PREFACE.

As this is the first occasion on which the reports of the Scientific Officers of the Agricultural Department are to be submitted in this form it will be as well to preface the description of work which has been conducted under my control by a statement of the considerations which will guide me in making my report. The main usefulness of this method of publication of research work will be that a permanent record of the progress of experiments will become available to others besides those officers actually engaged in the work. The value of such a record will lie mainly in the correlation of the climate, rainfall and other annual variable factors, with the experimental work described. The piecemeal publication of a large mass of experimental data obtained in the laboratory, which has no such relation to seasonal conditions would be of interest to few. Definite conclusions can rarely be drawn until the completion of the work, and the publication of incomplete results may be misleading. I have therefore decided to limit my report to the description of work which is either definitely dependent on the season or which is complete in itself. The progress reports of the Ganji Bar Experimental Station, the Green Manuring Experiments, the Sullage Experiments, and the statistics of Nitrogen Fixation will be included for the first reason, while the progress of the Soil Survey will be described as results become available.

THE GANJI BAR EXPERIMENTAL STATION.

Work was commenced on this Farm on the 10th of August 1918. It consists of 25 rectangles of mixed barren soils situated on distributary 9-L of the Lower Bari Doab Canal, at a distance of about 7 miles from Montgomery, within about 4 miles of Kahuta and 2 miles of Mir Dad Muafi stations on the North-Western Railway. There is a Canal Bungalow about 6 miles distant at Naiwala. It is surrounded by a large area of barren soils and was selected on this account, the particular location of the experimental farm being determined by the occurrence of what is reputed to be the most intractable soil in the Colony along with a quantity of soil of better quality. The area marked B in the plan has been reserved for extension, and those marked C for the settlement of tenants who will work under the direction of the Agricultural Department. The first area is to be devoted to scientific experiments on methods of reclamation. The result of the investigation it is essential should be forthcoming before work on the large scale is undertaken, as the problem shows itself to be much more complicated than was apparently anticipated when the original scheme was drawn up. The methods found successful will be tested on an economic scale in area B by means of steam tackle which is expected from England in the cold weather, and on area C by the tenants. The object of these economic experiments is to determine the most satisfactory conditions for bringing the 300,000 acres of bad land in the Colony into cultivation, the choice being between Government agency on the lines of the scheme drawn up by the late Mr. Barnes and Zemindari effort using bullock power as recommended by Mr. Roberts and Mr. Faulkner (see letter No. 301—1311-2, Financial Commissioner's Office, dated Lahore, 22nd June 1917) Kachcha Farm Buildings and quarters were completed in December 1918. A well is being sunk, and a comprehensive plan for the provision of pacca buildings, including an inspection bungalow, is in preparation. Meanwhile the staff engaged on the Farm is living in a most desolate spot under conditions which are not enviable.

The distribution of soils in this area, as described in Joseph's Soil Survey, is indicated in the map. Bara is credited with being the worst land, Bari is somewhat better, while Kalrathi is usually a light soil overlain with a thin alkaline crust which presents no particular difficulties in reclamation and is becoming fertile land in many parts of the Colony. The soils Bara and Bari form a graduated series. They usually crack up into hexagonal shaped clods of a porous texture : the worst Bara frequently shows a uniform surface, but the position of the soil in this series may usually be judged by the thickness of the clod formed. The thicker the clod the worse will be the soil. This classification of the soils is of course based on empirical considerations, and there is frequently great variation in opinion among Zemindars and Revenue Officials who have had experience of the land, as to what is real Bara, and what soil is worse than another. A soil is called normal in Joseph's Soil Survey if grass grows on it. Mechanical and Chemical analyses have been made from time to time of the various soils met with. These are reproduced in the following tables : the mechanical constitution of the soils analysed is depicted in diagram I, from which, and the figures in table I it will be seen that there is no constitutional difference between the so-called Bara and normal soils

MAP REPRODUCED FROM JOSEPH'S SOIL SURVEY, SHOWING SURROUNDINGS OF THE GANJ BAR EXPERIMENTAL STATION.

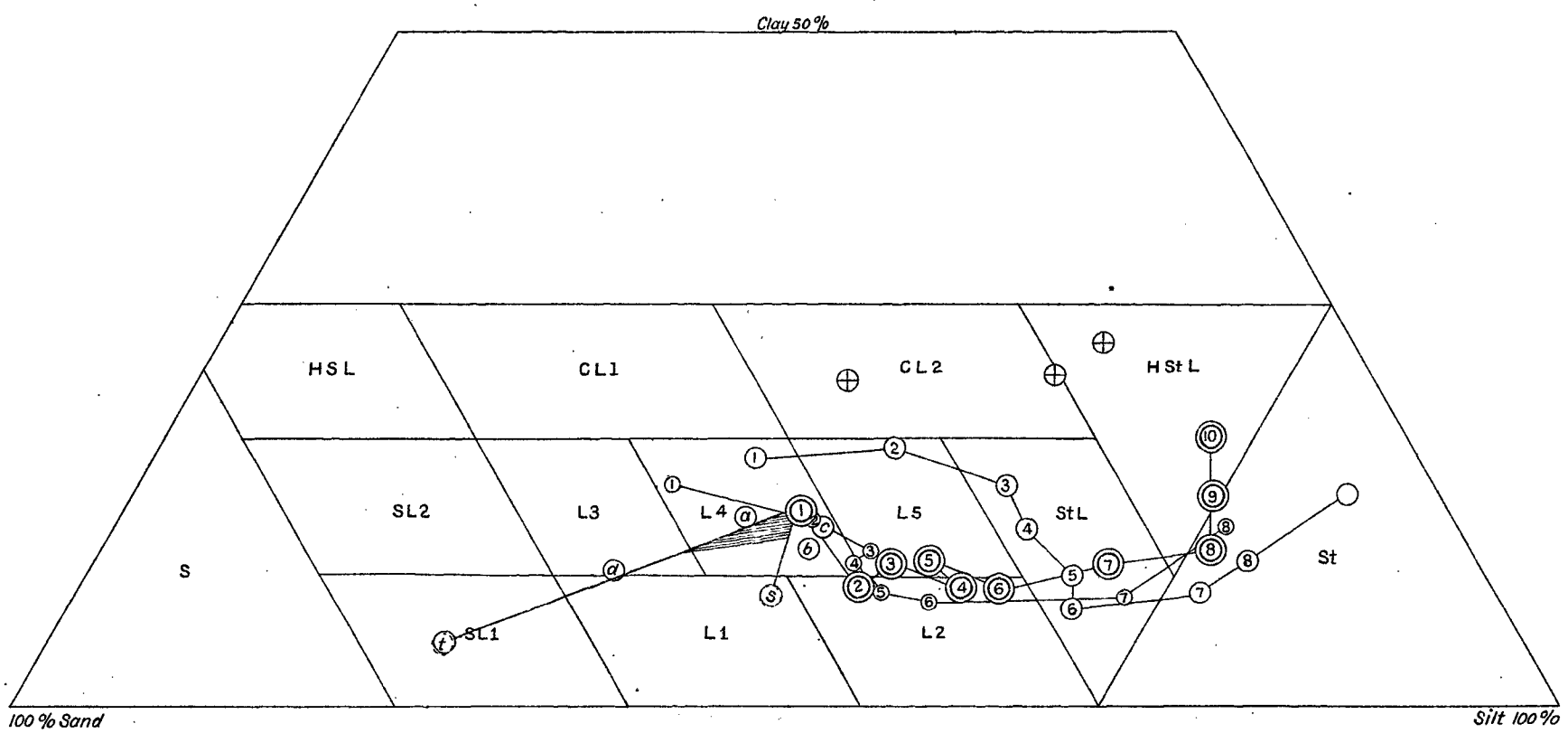
Table I.

	Number and description of sample.	Fine gravel.	Coarse sand.	Fine sand.	Silt.	Fine silt.	Clay.	Soluble matter and moistures.	Designation.
		Per cent. on air dry fine earth.							
1	Chak 95 (I pit) I foot ...	·26	·35	37·42	20·09	20·5	11·12	10·03	Bara.
2	Chak 95 (Do.) II „ ...	·05	·16	30·08	24·33	23·9	10·40	10·36	Do.
3	Chak 95 (Do.) III „ ...	*Nil*	·47	33·81	15·47	24·2	10·88	12·74	Do.
4	Chak 95 (Do.) IV „ ...	1·34	·24	28·77	22·47	24·6	10·64	12·74	Do.
5	Chak 96 (II pit) I foot ...	·73	·56	41·45	15·68	22·0	11·92	10·96	Do.
6	Chak 96 (Do.) II „ ...	·17	·49	59·71	12·30	9·0	6·40	12·55	Do.
7	Chak 96 (Do.) III „ ...	·01	·39	47·40	18·96	11·0	8·18	13·2	Do.
8	Chak 96 (Do.) IV „ ..	*Nil*	·35	45·68	28·21	13·0	6·16	9·79	Do.
9	Chak 98, square 22. (I pit) I foot ...	*Nil*	1·58	50·37	16·94	14·4	9·36	5·27	Bari.
10	Chak 98, square 22. (Do.) II „ ...	*Nil*	1·27	51·22	15·83	14·7	10 72	5·5	Do.
11	Chak 98, square 22. (Do.) III „ ...	*Nil*	1·14	50·17	17·55	17·7	9·76	5 13	Do.
12	Chak 98, square 43. (IV pit) I foot ...	*Nil*	1·29	38·45	20·07	18·2	12 56	8·58	Do.
13	Chak 98, square 50. (III pit) I foot ...	*Nil*	2·19	45·21	14·23	16·3	13·20	11·38	Do.
14	Chak 98, square 50. (Do.) III „ ...	·10	1·08	42·08	15·60	15·1	11·20	15·91	Do.
15	Chak 98, square 50. (Do.) V „ ...	·03	·50	20·54	15·19	32·0	16·96	14·23	Do.
16	Chak 98, square 50. (Do.) VII „ ...	*Nil*	·61	21·96	13·93	33·8	17·12	12·61	Do.
17	Kahuta, square 42. (I pit) I foot ...	·06	·19	43·08	18·89	15·2	14·00	7·84	Do.
18	Kahuta, square 42. (Do.) II „ ...	·02	·18	45·29	1[illegible]·04	14·8	13·20	6·91	Do.
19	Kahuta, square 42. (Do.) III „ ...	·37	·17	44·23	16·25	13·5	13 84	10·75	Do.
20	Kahuta, square 60. (II pit) I foot ...	*Nil*	·15	47·50	14·76	10·6	11·76	13 88	Kalrathi.
21	Kahuta, square 60. (Do.) II „ ...	*Nil*	·16	53·56	12 69	8·4	8·16	15·36	Do.
22	Kahuta, square 60. (Do.) III „ ...	*Nil*	·17	56·16	13·34	6·6	6·48	15·65	Do.
23	Kahuta, square 80. (III pit) I foot ..	·04	·15	33·99	15·77	16·2	15·12	11·13	Bara.
24	Kahuta, square 80. (Do.) II „ ...	*Nil*	·13	29·36	11·59	17·6	14·72	16·65	Do.

Moreover, the sequence of sub-soils shows that the character of the surface soil is not determined entirely by this factor; thus for instance, the normal soil No. 201 has a similar sub-soil to the Bara No. 297 (Table V, pages 132 and 133) occurring alongside. In the case of the Kalrathi soil in Chak 96 it is to be noticed that it is underlain by a sub-soil of much lighter texture. This is connected with the fact that it is comparatively easily reclaimed. From a consideration of the mechanical analysis alone we are led to the conclusion that there is no *constitutional* abnormality in these soils. The soils are frequently described as heavy clay soils, but this is not the case, as comparison with some other typical soils plotted on the diagram will show. The variation in mechanical composition caused by the addition of sand and silt is also shown in the diagram. The complete range of soils which can be formed by mixing two soils must lie along the line joining the points representing the constitution of the two soils used. It will be seen that the effect of admixing a practicable proportion of the coarser soil does not bring about such a large change in the constitution of the soil as would warrant our concluding that any beneficial action resulting is to be attributed to change in texture. The mechanical analysis of an average canal silt and also of a sand which may be taken as representative of tibba soil is shown in the table. The two points *t* and *s* represent these soils in the diagram. The area cross hatched represents the composition of such soils as would be formed by adding 30 per cent. of these soils to the Bara. It will be seen that the area does not go beyond that occupied by typical Bara soils. The greater fertility of a spot in a field where a tibba has existed and which has been levelled out is a frequent sight in the district, and is probably responsible for this idea. The fertility is however usually restricted to the immediate spot where the tibba was, and therefore is no proof that it is the sand, which has been spread equally over the whole of the field which has improved the soil. The organic matter in the sub-soil of the tibba may be solely responsible for the fertility observed.

Table 2 shows the chemical analysis of a selection of soils. It will be seen that the total soluble salts vary from about 0·3 per cent. to nearly 3 per cent.

DIAGRAM 1.



The area cross-hatched in red represents Soils formed by mixing up to 30% of t and s with Bara

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Table II.

CHEMICAL ANALYSES OF MONTGOMERY SOILS.

Description of the soils.			In 10% water extracts of soils.										Hydrochloric Acid extract.		
			Total soluble matter.	Alkalinity as sodium carbonate.	Alkalinity as sodium bicarbonate	Sulphur as sodium sulphate.	Chlorine as sodium chloride.	Total Alkali as sulphate.	Sodium sulphate (by difference)	Potash sulphate.	Potash as K_2O.	Nitrate Nitrogen.	Calcium oxide.	Magnesium oxide.	Total carbonate as calcium carbonate.
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Bara, Chak 95	0—1′	...	0·59	0·08	0·07	0·18	0·11	1·53	1·343	0·187	0·101	0·0039	4·61	1·33	8·25
„ „	1′—2′	...	0·46	0·10	0·06	0·02	0·08	0·67	0·518	0·152	0·082	0·0030	5·30	2·43	7·39
„ „	2′—3′	...	0·40	0·09	0·09	Traces.	0·05	0·56	0·375	0·185	0·100	0·0026	6·98	1·77	11·13
„ „	3′—4′	...	0·33	0·11	0·06	Traces.	0·04	0·49	0·362	0·128	0·069	0·0015	5·05	0·74	9·33
Bara, Chak 96 (Faizpur).	0—1′	...	0·46	0·02	0·06	0·07	0·08	0·67	0·509	0·161	0·087	0·0033	5·57	1·88	8·23
„ „	1′—2′	...	0·45	0·09	0·05	0·02	0·06	0·84	0·677	0·163	0·088	0·0012	5·98	1·93	10·61
„ „	2′—3′	...	0·44	0·08	0·11	0·03	0·05	0·65	0·496	0·154	0·083	0·0007	6·27	1·10	10·20
„ „	3′—4′	...	0·35	0·08	0·05	0·01	0·05	0·55	0·341	0·209	0·113	0·0009	6·22	1·10	8·07
Bari, Chak 98, sq. 22	0—1′	...	0·60	*Nil*	0·03	0·13	0·23	0·54	0·381	0·159	0·086	0·0036	2·65	1·49	3·02
„ „ 98, sq. 22	1′—2′	...	0·67	*Nil*	0·03	0·15	0·29	0·53	0·341	0·189	0·102	0·0025	2·55	0·90	3·20
„ „ 98, sq. 22	2′—3′	...	0·39	*Nil*	0·03	0·07	0·21	0·43	0·293	0·137	0·074	0·0018	2·90	1·80	4·05
Bari, Chak 98, sq. 43	0—1′	...	1·27	0·01	0·07	0·64	0·45	1·48	1·314	0·166	0·090	0·0002	3·68	2·35	4·80
„ „ 98, sq. 50	0—1′	...	1·22	0·04	0·05	0·38	0·61	1·49	1·298	0·192	0·104	0·0007	5·43	1·80	9·40
„ „ 98, sq 50	2′—3′	...	1·37	0·02	0·02	0·64	0·53	1·43	1·264	0·166	0·090	0·0003	8·62	1·36	10·80
„ „ 98, sq. 50	4′—5′	...	1·77	0·01	0·03	0·80	0·78	2·00	1·778	0·222	0·120	0·0003	5·98	2·59	8·91
„ „ 98, sq. 50	6′—7′	...	2·07	0·01	0·02	0·96	0·91	2·30	1·973	0·327	0·177	0·0004	4·87	2·95	8·30
Bari, Kahuta, sq. 42	0—1′	...	2·93	0·11	0·08	0·35	0·16	0·65	0·502	0·148	0·080	0·0025	3·52	1·43	5·77
„ „ sq. 42	1′—2′	...	0·77	0·12	0·09	0·25	0·14	0·91	0·745	0·165	0·089	0·0019	3·21	0·93	4·00
„ „ sq. 42	2′—3′	...	0·45	0·11	0·09	0·07	0·09	0·74	0·616	0·124	0·067	0·0013	5·56	0·75	10·75
Kalrathi, Kahuta, sq. 60	0—1′	...	1·79	0·03	0·03	0·63	0·55	2·00	1·706	0·294	0·159	0·0005	6·23	1·02	9·13
„ „ sq. 60	1′—2′	...	1·30	*Nil*	0·03	1·04	0·15	1·38	1·047	0·333	0·180	Traces.	15·18	4·31	10·91
„ „ sq. 60	2′—3′	...	1·63	*Nil*	0·02	1·30	0·12	1·15	0·930	0·220	0·119	Traces.	8·16	2·33	10·57
Bara, Kahuta, sq., 80	0—1′	...	0·87	0·08	0·07	0·28	0·30	1·11	0·931	0·179	0·097	0·0022	5·92	1·39	5·60
„ „ sq., 80	1′—2′	...	0·30	0·12	0·06	0·01	0·05	0·69	0·509	0·181	0·098	0·0004	8·60	1·25	17·00

Table 3 shows the soluble matter and alkalinity, etc., of samples of reh soils from various parts of the Province. It will be seen that the Bara soils in comparison do not contain nearly so much soluble matter as is the case with the ordinary reh soil. The alkalinity, moreover, is not remarkably high, or often beyond what has been frequently observed such crops as wheat, sorghums, lucern, etc., can tolerate (up to about 0·08 per cent.). It will be seen that a rough correlation exists between the sodium carbonate content of the soils examined and their intractibility. The soil appears to be worst when sodium carbonate is high and total soluble matter relatively low (Nos. 13, 14, 15, 9, 10, &c.). When total solids are comparatively high, the soil becomes of the Kalrathi type, similar to the ordinary reh soil, No. 17 would thus be more accurately described as a Kalrathi soil, although it has been classed as Bara.

Table III.

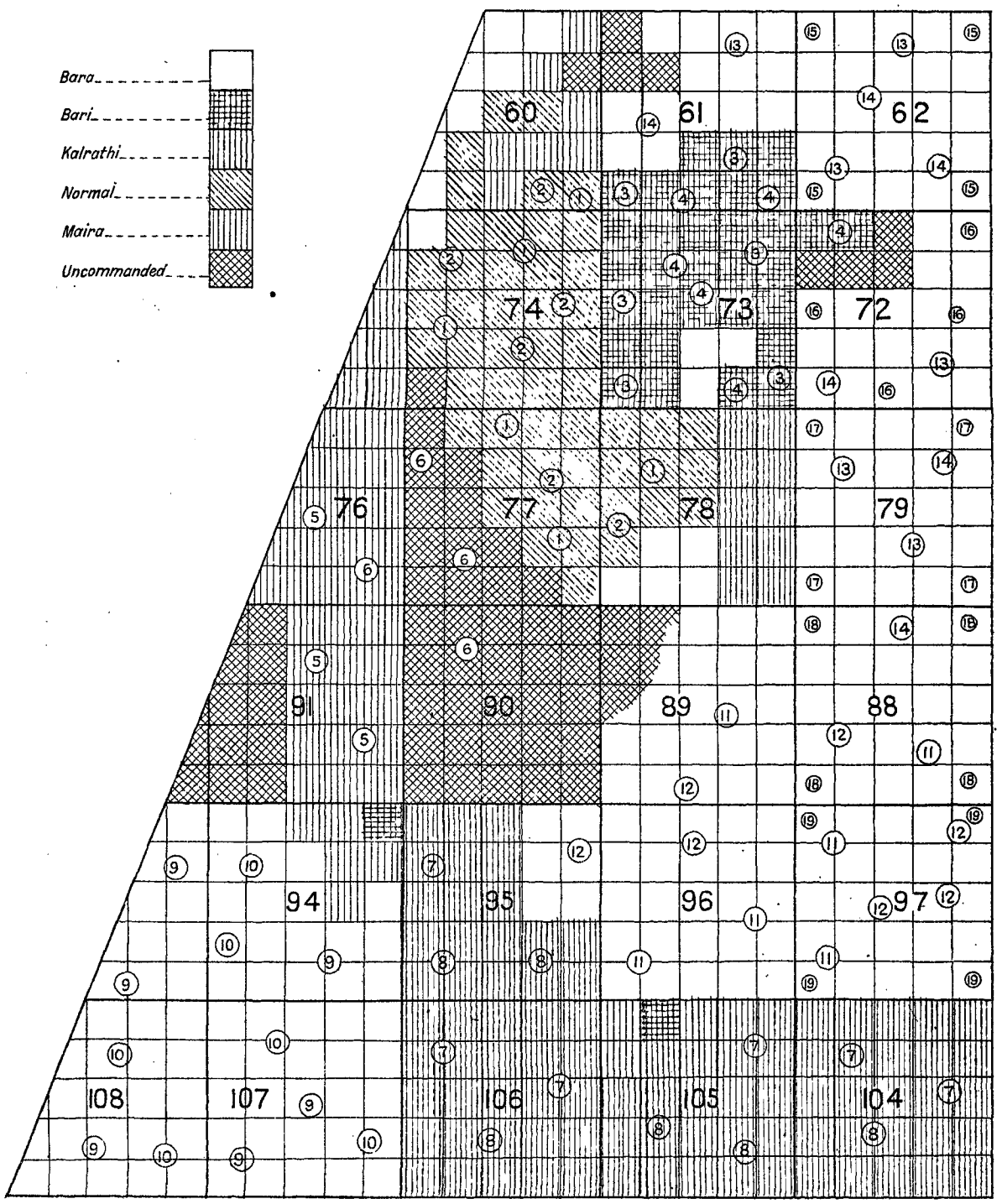
ANALYSES OF REH SOILS FROM DIFFERENT LOCALITIES.

Description of soil.	Total soluble matter.	Alkalinity as sodium carbonate,	Chlorine as sodium chloride,	Sulphur as SO_3.	Sulphur as sodium sulphate.	Remarks.
		(Per cent. on air dry fine earth.)				
Jehlum, Top 6 inches	4·13	·053	·9	1·38	2·45	
„ Second „	4·21	·055	·9	1·42	2·53	
„ Third „	3·13	·053	·66	1·17	2·08	
Muzaffargarh, Top 3 inches	13·6	7·1	·54	2·73	4·86	
Second „	1·68	·87	·16	·31	·552	
Third „	0·53	·053	·06	·09	·1602	
Fourth „	0·36	·265	·09	·044	·078	
Gurgaon, Village Hodal, Top 6 inches	5·004	·085	2·0	·064	·114	
„ „ „ Second, „	1·40	·085	·63	·005	·0089	
„ „ „ Third „	0·96	·32	·45	·018	·032	
Lyallpur Surface soils 9″ depth (Narwala)	4·408	·212	1·227	1·446	2·57	
	2·488	·268	·526	1·013	1·803	
	2·79	·159	...	1·337	2·38	
	2·00	·1325	·148	·910	1·62	
Average for 15 Narwala soils	1·846	·1806	·441	·6953	1·237	

Comparing the clay content of these soils with Narwala Reh soils it is found that whereas the average for the Narwala soils is about 15 per cent., for Bara it is if anything below this figure. The main difference in behaviour of the two soils lies in the fact that the Bara soils are almost impervious to water. It has been frequently observed that a soil containing a fairly large percentage of clay and in addition alkaline salts may have its fertility actually reduced by the removal through leaching of the soluble salts. This reduction of fertility is associated with the loss of 'tilth.' The clay, originally flocculated, becomes deflocculated, and this condition of the clay tends to cement together the soil particles, rendering the soil impervious to water. This is precisely the state of affairs with 'Bara' soils. On mixing the soils with water the clay remains in suspension almost indefinitely, instead of precipitating in flocks as will be the case with the normal healthy soil. To this peculiar colloidal condition of the clay must the abnormality of these soils be mainly attributed. The Montgomery soils which exhibit the worst 'Bara' qualities are usually low lying and subject to wash when rain falls; as previously pointed out, chemical examination shows that they are usually characterised by fairly high sodium carbonate content and relatively low total soluble matter; their bad condition is thus explicable. Our first object must be to improve this deflocculated condition of the clay. Reclamation will be impossible unless the soil can be rendered sufficiently pervious to water to enable the sodium carbonate present, which is responsible for keeping the clay deflocculated, to be washed out or 'antagonised.' It is therefore mainly the sodium carbonate of the soil which presents the most favourable point of attack for the problem.

Biological Examination.

Besides investigation of the mechanical and chemical properties of these soils biological examination was also tried. The object aimed at in this type of experiment is the determination of the probable fertility of the soil under optimum conditions, by examination of what may be called its geniality for the development and functioning of soil bacteria. For this purpose use is made of the behaviour in the soil of bacteria responsible for the process of nitrification. A sufficient amount of nitrogenous food in some form or other is added to the soil which has undergone various treatments. An inoculation from a normal soil containing the bacteria is given, and the amount of nitrogen converted into the nitrous and nitric forms is determined after the lapse of a period of incubation about four or five weeks. The method must be regarded as purely conventional, but the results obtained may be used qualitatively to draw conclusions as to the value of the treatment to which the soil has been subject improving its fertility. In the present case nitrification could not be induced in the untreated Bara soil. The soil was consequently washed to remove as much as possible of the soluble salts it contains. After three shakings with 100 per cent. of distilled water the salt content was reduced to about 0·18 per cent. The soluble salt content of a normal soil on which a wheat crop was growing in the same locality was found to have a salt content, determined in the same manner, of 0·168 per cent. We may thus conclude that the washing has been effective in reducing the salt content to about the same amount as occurs in fertile soils of the district. Using such a quantity of oil-free sarson cake as contained 60 milligrams of nitrogen for each 100 grams of soil, the amounts nitrified per 100 grams in five weeks are shown in table IV.



Ganjil Bar Experimental Farm Montgomery

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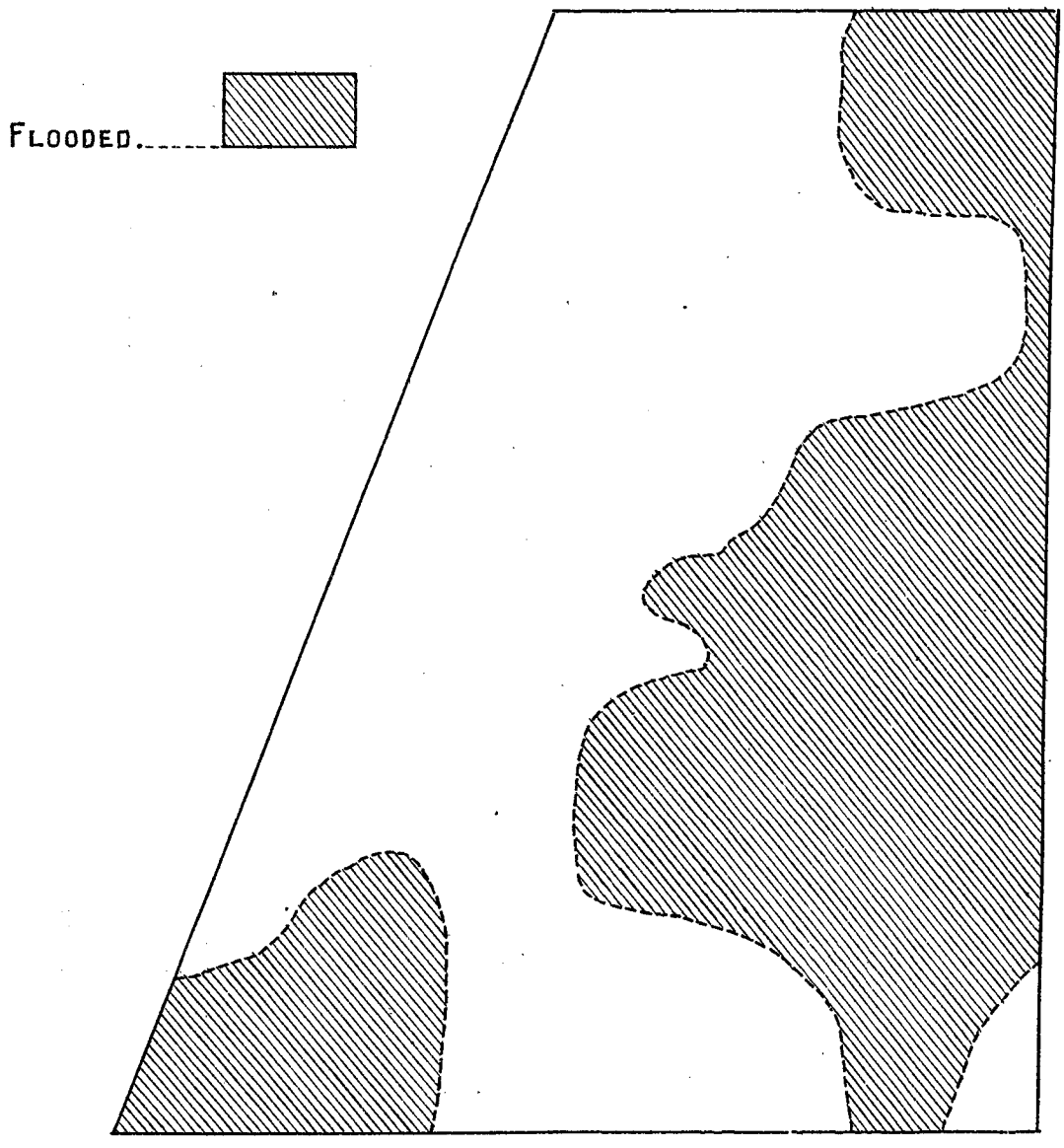

DIAGRAM 3.

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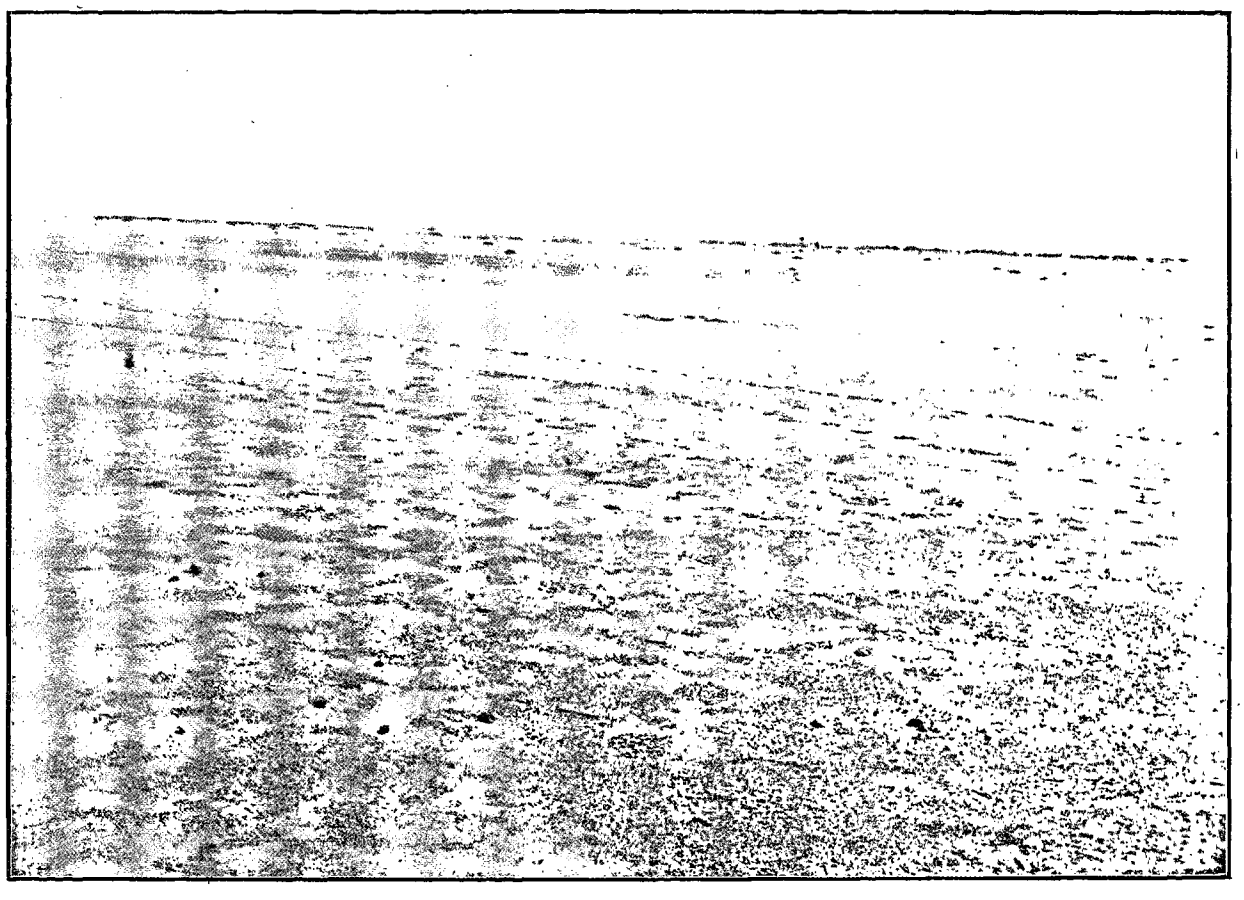
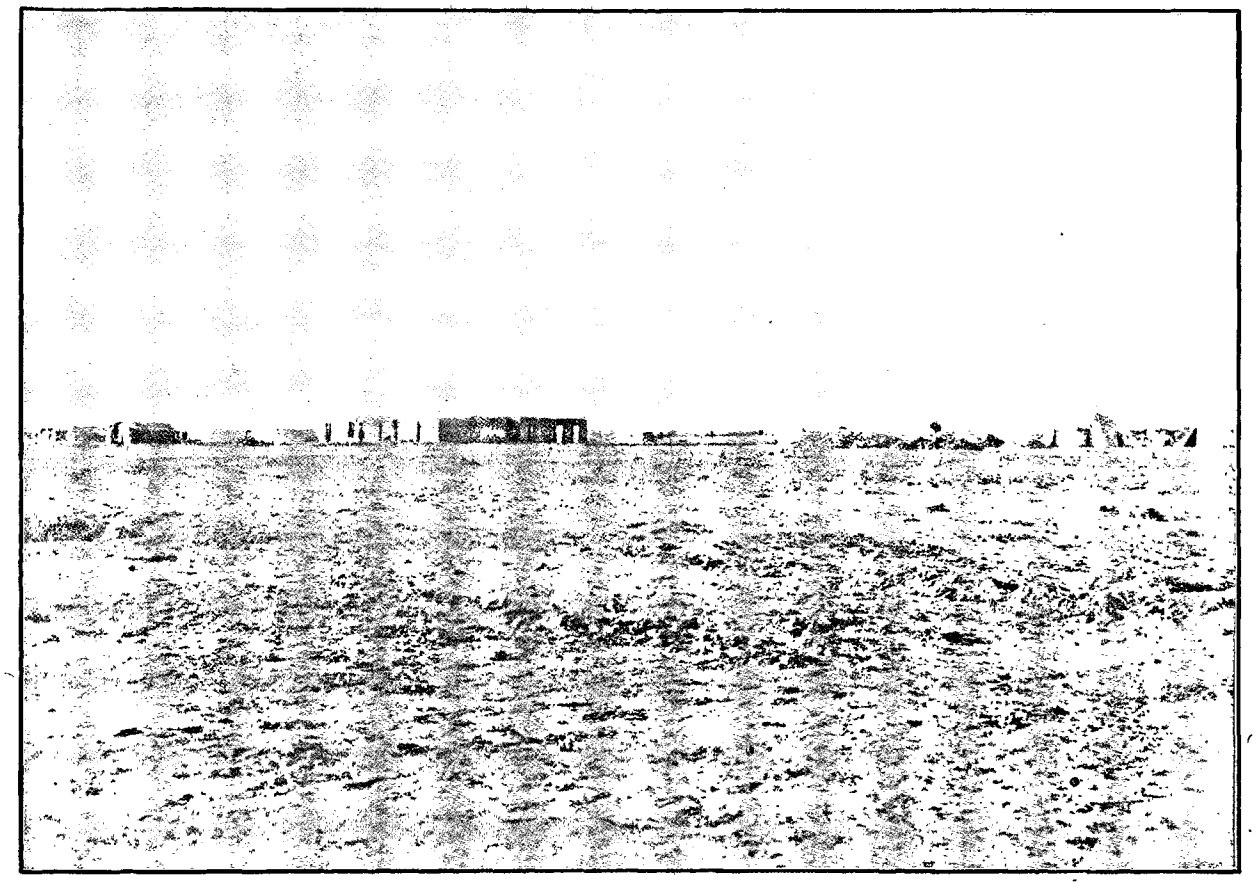
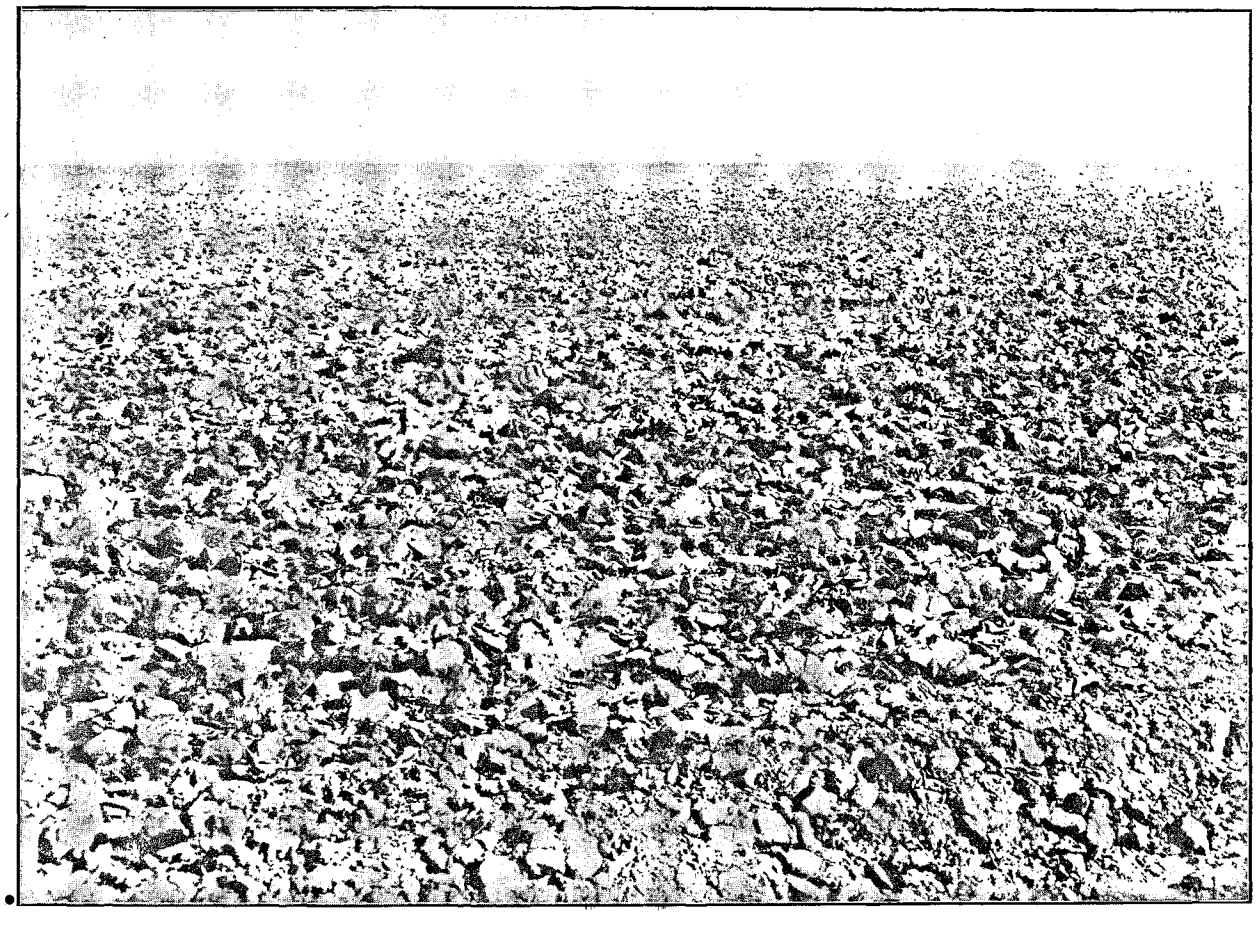


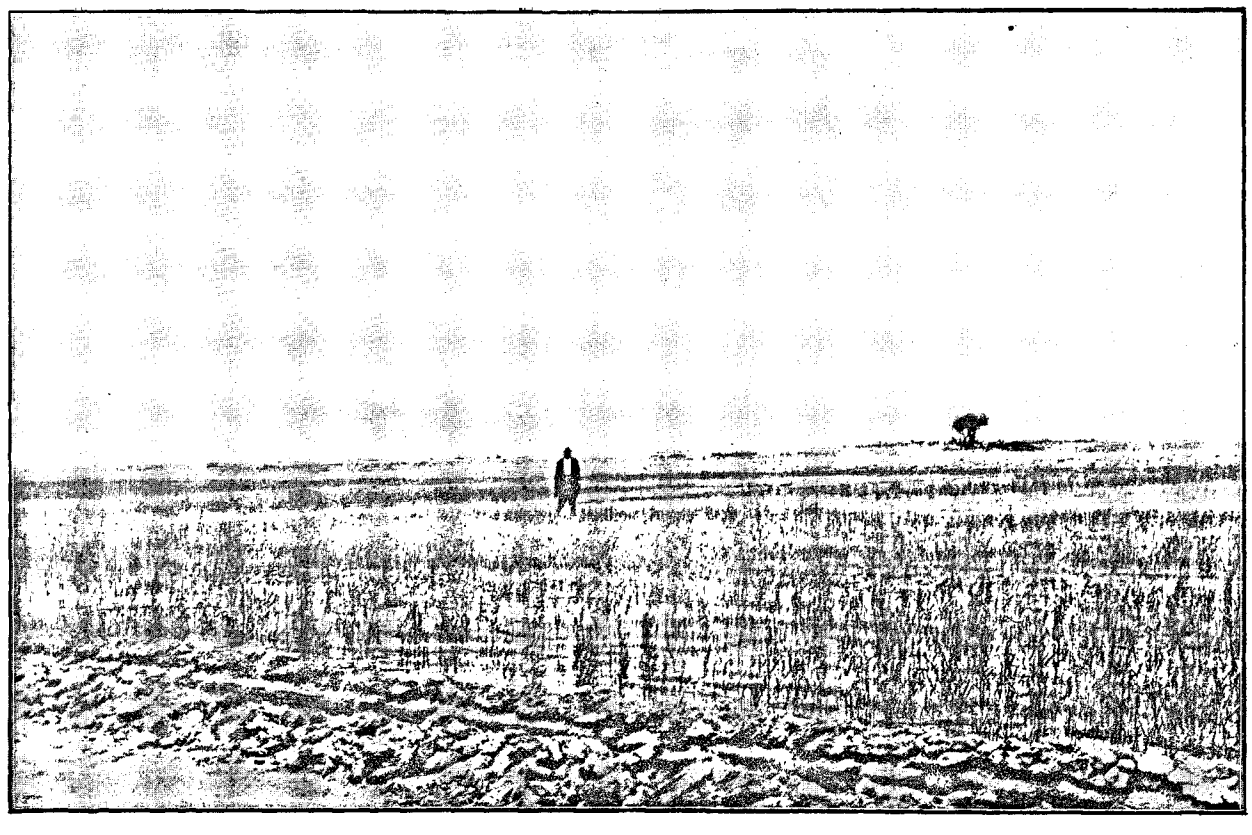
The Experimental Farm before cultivation: 1918.



The Farm Buildings: 1918.



Bara soil broken with steam cultivator.



First wheat crop on Bari soil. Square 73. 1918—1919.

Table IV.

ABSTRACTED TABLE SHOWING NITROUS AND NITRIC-NITROGEN RESPECTIVELY AFTER AN INCUBATION OF 4 TO 5 WEEKS AT 30° IN WASHED BARA SOIL. MILLIGRAMS OF NITROGEN PER 100 GRAMS OF SOIL.

	Nitrous-Nitrogen.	Nitric-Nitrogen.
1. Normal Soil	12·30	7·027
2. Washed Bara Soil	10·6	4·52
3. Washed Bara Soil (Aerated)	8·64	8·16
4. Six gms. Ca CO_3 added (1%)	13·93	8·47
5. Twelve gms. Ca CO_3 added (2%)	8·64	13·20
6. Eighteen gms. Ca CO_3 added (3%)	9·41	10·75
7. Soil boiled for an hour, dried, inoculated and dilute Omeliansky's solution added.	10·66	10·34
8. As in No. 7, but no Omeliansky's solution ...	10·66	3·34
9. Chloroform treated soil, dilute Omeliansky's solution.	10·66	7·26
10. As in No. 9, but without Omeliansky's solution.	14·54	3·66
11. Toluene treated soil and dilute Omeliansky's solution.	8·42	9·50
13. As in No. 11, but without Omeliansky's solution.	12·30	1·98
13. 2% Carbon added and dilute Omeliansky's solution.	8·0	10·20
14. As in No. 13, but without Omeliansky's solution.	8·0	6·56

The conclusions which may be drawn from these experiments are as follows:—

(1) Mere reduction of the soluble salt content of the soil does not restore the fertility to the same degree as that of normal soils of similar constitution.

(2) Aeration, which may destroy toxic material in the soil by oxidation, restores the nitrifying power to that of the normal soil.

(3) The addition of calcium carbonate similarly improves the fertility, a 2 per cent. addition inducing more nitrification than in the normal.

(4) Boiling the soil with water, reduces the nitrifying power, but if afterwards a saline solution is added the nitrification improves on the normal soil. (Omeliansky without the Ammonium Sulphate as follows:—

$NaCl$	... ...	0·5 gm.
K_2HPO_4	... ...	0·25 „
$MgSO_4$	... ...	0·125 „
$FeSO_4$	... ...	0·1 „
Water	... ...	One litre.

(5) Similar results are obtained in the case of the treatment of the soil with chloroform, toluene and carbon, all of which methods might result in the removal of toxic material. Aeration alone is thus seen to reduce the soil fertility and it will therefore probably be unnecessary to attempt any other treatment during reclamation. The effect of additions of calcium carbonate may possibly produce some amelioration of the soil although it is probable that the increased nitrification observed is due to the removal of unfavourable conditions inherrent in the experiment. Field applications may be tried, but as the soil already contains from 8 to 10 per cent. of calcium carbonate it is not likely that any reaction will be observed.

We may thus conclude that washing and aeration, operations which are within our reach by ordinary Agricultural methods, should be sufficient to reclaim the soils, provided their permeability can be sufficiently increased to facilitate washing.

Cultural Experiments.

The discussion of the results of chemical examination given above indicates that the main object in reclamation work must be firstly to improve the texture of the soils so that washing of injurious salts present may be effected. It will then be necessary to introduce organic matter, which, with the establishment of a healthy soil flora, will add to the nitrate content of the soil, and possibly, by the production of "protective" colloids, help in improveing the texture. The action of gypsum in flocculating colloids is well known: it is also capable of reacting with alkaline carbonates present forming the less toxic sulphate which is more easily washed away. This reaction, which is represented by the following chemical equation, never proceeds completely in the direction represented by the top arrow.

$$Na_2CO_3 + CaSO_4 \rightleftharpoons Na_2SO_4 + CaSO_4$$

It is thus possible that the amount of alkaline carbonates remaining in equilibrium with the calcium sulphate (gypsum) added may still be toxic, but the method has been frequently used successfully. The use of sulphuric acid has been advocated in what seems to be a similar abnormal soil by Lipman and Sharp. The use of sulphuric acid on a small scale is therefore being tried, as by its use in the correct amount the alkalinity due to sodium carbonate may be completely removed. The results obtained in this way are likely to have more scientific than practical use, as the expense would probably put sulphuric acid out of court for reclamation purposes. In addition to these experiments, the action of additions of sand and silt are also being tried. As was pointed out above there is a general idea prevalent that this is useful in improving the land, although there are no grounds for supposing that any improvement which may result is due to improving the mechanical constitution of the soil. A coarse sand may, however, have some action in opening up the soil thus allowing washing to proceed more satisfactorily. The effect of spreading sand from "tibbas" or sand hills is being tried, as also is that of canal silt. This latter experiment was undertaken at the request of the Canal Department, the object being to sediment on the surface of the soil as much of the coarser particles carried by the water as possible.

In all cases a green manuring crop will be ploughed in first of all. The effect of the addition of organic material from a previous crop, no matter how poor the crop may have been, is already evident in the germination and growth of plots 78-A 1, 2, 3 (Bari) where a poor crop of turnips was obtained which was fed to cattle in January. Similarly on plots 78-B, C, E, where wheat was sown last year, the germination of jowar and guara has been better than on similar land.

With all experiments designed to test the above factors the cultural operations have been performed in duplicate with the Raja Plough and the steam cultivator. The latter cultivates to a depth of 8 to 13 inches. Besides variation of the kind of cultivation the effects of the number of cultivations and the amount of water used have also to be determined. A

a	b	c	d	e	
Calcium Sulphate.	Two Tons	p a.			1
Untreated			$CaSO_4$: Untreated Sulphuric Acid Untreated $CaSO_4$:		2
Calcium Sulphate.	One Ton	p.a.			3
Untreated		79			4
Calcium Sulphate.	One half Ton.				5
Untreated.					1
$CaSO_4$:	One Ton.		$CaSO_4$ Untreated Sulphuric Acid Untreated $CaSO_4$:		2
Untreated.		88			3
Calcium Sulphate:	Two Tons.				4
Untreated.					5

District Board Road

San. | Guara | Unmanured | San | Guara.

The whole line of each Square Green manured with.

DIAGRAM 4.

5700-5

careful record of the amount of water used on each plot is being kept: the measurements, which rely on the discharge from a Kennedy Gauge outlet are necessarily liable to considerable errors, and the unreliability of the watercourses made in these soils is a further trouble. A more satisfactory system of measurement is now under consideration.

The other experimental treatments which may be mentioned are first, rice cultivation and secondly the breaking up of the sub-soil with dynamite in the hope of increasing the percolation.

The method of laying out the experiments may be exemplified in one case. Reference to the statement at the end of this section will then enable the treatment which other plots have received to be understood without reference to a diagram.

The system of plot marking which has been adopted may first be explained. Each rectangle of 25 acres is numbered from east to west by the first five letters of the alphabet, and from north to south by the first five numerals. Thus the acre in the extreme south-east corner is called E-5, and the plots proceeding diagonally to the north-west corner, D-4, C-3, B-2 and A-I. This system has many advantages over that used in the Colony of numbering the plots successively from 1 to 25.

The diagram 4 shows the method of varying the three factors cultivation, chemical treatment and crop. Besides the testing of gypsum in applications of various amounts, a similar experiment on plots of 1/10 acre has been arranged for the sulphuric acid trials in Killas 79/D2, E2 and 88/D2, E2. It will be seen that San is the crop used in the A and B lines of both the squares, as is guara in the B and E lines: applications of gypsum are similarly made at the rate of 2 tons to the acre in line 1 of 79 and 4 of 88.

It is too early yet to be able to form any opinion of the effect of the chemical treatment and cultivation factors. The green manuring crop first sown this year was spoiled by excessive rain which fell in July and produced flood water which stood in the fields for 5 or 6 days. This has necessitated the resowing of all experimental plots. From the point of view of designing a method of reclamation to be used on the large scale, it will of course be necessary to rely on the addition of organic matter to the soils from the crops which can be induced to grow on the land itself. The effect of the addition of amounts of green manure equivalent to a normal crop may, however, be tested by applying fodder grown elsewhere and cut. This will be done on 1/10 of an acre in each experimental plot so that by next year it will be possible to form a rough idea of the probable effect of green manuring.

Tables V, VI and VII give the mechanical and chemical analyses of the Farm plots. As work proceeds further analyses will be made in order to check the influence of the treatment employed.

Details of all operations are given in the statement which follows.

Table V.

MECHANICAL ANALYSES OF SOILS FROM G. B. E. S., MONTGOMERY.

Register No., year 1918.	Designation.	Description.	Percentage on air dry fine earth.							Type.	Diagram No.
			Fine gravel.	Coarse sand.	Fine sand.	Silt.	Fine Silt.	Clay.	Soluble matter and Hyg. moisture.		
201	Normal ...	0—6″	·63	·63	39·56	18·47	18·88	13·12	7·59	L_4	1
202	„ ...	„	·22	·76	39·42	15·08	19·60	17·60	7·26	„	2
203	„ ...	6″—12″	·30	·53	30·49	23·58	18·72	13·60	8·45	L_5	1
204	„ ...	„	·23	·41	30·23	20·45	23·28	18·24	8·32	„	2
205	„ ...	1′—2′	·43	·50	19·10	26·82	26·66	14·56	11·04	S_tL	1
206	„ ...	„	·60	·43	23·55	24·62	26·24	16·00	9·69	„	2
208	„ ...	2′—3′	·21	·66	24·58	27·51	24·0	13·12	10·91	„	2
209	„ ...	3′—4′	·02	·43	22·43	36·65	21·92	8·88	8·62	„	1
210	„ ...	„	·28	·11	23·64	30·07	24·72	11·84	9·85	„	2
211	„ ...	4′—5′	·03	·37	26·04	38·55	17·76	6·88	7·80	„	1
212	„ ...	„	·05	·46	30·04	27·80	22·56	10·88	9·07	L_5	2
213	„ ...	5′—6′	·02	·34	16·47	45·42	19·76	8·16	7·83	S_t	1
214	„ ...	„	·17	·22	17·45	41·78	21·36	11·76	8·52	HS_tL	2
215	„ ...	6′—7′	·04	·16	8·22	51·39	23·44	8·32	8·02	S_t	1
216	„ ...	„	*Nil*	·28	12·23	42·84	25·84	10·56	8·45	„	2
217	„ ...	7′—8′	·08	·40	4·39	33·76	37·44	13·60	9·40	„	1
220	„ ...	8′—9′	·07	·31	8·53	13·46	44·16	22·48	10·52	HS_tL	2
221	„ ...	9′—10′	·01	·19	22·72	15·78	32·48	15·76	10·70	S_tL	1
222	„ ...	„	*Nil*	·25	18·86	13·06	39·28	18·48	10·15	CL_3	2
223	„ ...	10′—11′	·16	·24	45·52	23·68	13·20	7·20	11·24	L_1	1
224	„ ...	„	*Nil*	·23	42·82	29·50	11·44	3·52	11·92	„	2
225	Eari ...	0—6″	·13	·60	43·64	15·80	16·40	14·72	7·17	L_4	3
227	„ ...	6″—12″	·61	·54	37·18	20·78	19·04	13·36	7·61	„	3
229	„ ...	1′—2′	·12	·40	34·18	25·48	19·68	9·76	8·68	L_5	3
231	„ ...	2′—3′	·36	·37	35·32	25·18	20·08	10·32	8·91	L_4 or L_5	3
233	„ ...	3′—4′	·35	·36	35·67	27·20	19·76	8·88	8·99	L_2	3
235	„ ...	4′—5′	*Nil*	·40	33·88	32·38	16·80	7·36	8·99	L_2	3
237	„ ...	5′—6′	·23	·01	21·01	39·35	19·60	8·72	9·55	S_tL	3
239	„ ...	6′—7′	·22	*Nil*	12·47	30·17	32·08	12·56	10·44	S_t	3
241	„ ...	7′—8′	·19	·65	51·72	16·18	8·64	8·00	10·37	SL_1	3
243	„ ...	8′—9′	·14	·47	42·89	20·96	13·04	9·52	11·05	L_4	3
245	„ ...	9′—10′	*Nil*	·30	8·49	10·34	46·64	22·40	11·74	HS_tL	3
247	„ ...	10′—11′	„	·16	12·81	18·54	41·04	15·84	12·39	HS_tL	3
249	Maira ...	0—6″	„	·28	55·48	20·60	12·48	5·92	5·54	L_1	5
250	„ ...	„	„	1·61	65·23	13·57	9·76	4·80	5·37	SL_1	6
251	„ ...	6″—12″	„	·65	45·41	16·83	16·16	10·24	5·87	L_3	5
252	„ ...	„	·08	·69	46·44	21·77	14·40	11·92	6·25	L_4	6
253	„ ...	1′—2′	·18	·35	31·73	30·32	18·08	11·2	8·32	L_5	5
254	„ ...	„	·23	·37	31·99	30·01	22·48	12·16	6·72	„	6

MECHANICAL ANALYSES OF SOILS FROM G. B. E. S., MONTGOMERY—*concluded.*

Register No., year 1918.	Designation.	Description.	Percentages on air dry fine earth.							Type.	Diagram No.
			Fine gravel.	Coarse sand.	Fine sand.	Silt.	Fine Silt.	Clay.	Soluble matter and Hyg. moisture.		
255	Maira ...	2′—3′	·16	·43	38·77	24·84	10·88	12·48	6·62	L_2	5
256	„ ...	„	*Nil*	·65	36·99	26·36	17·68	12·64	6·29	L_5	6
257	„ ...	3′—4′	*Nil*	·69	35·81	28·16	19·52	11·04	6·49	L_5	5
258	„ ...	„	·30	·33	34·55	27·47	15·40	8·48	9·16	L_2	6
259	„ ...	4′—5′	·35	·44	34·48	29·62	18·40	6·64	6·46	L_2	5
260	„ ...	„	·09	·24	33·78	32·20	17·92	8·32	8·76	„	6
273	Kalrathi ...	0—6″	·10	·42	41·20	15·08	11·32	17·60	8·13	L_4	7
274	„ ...	„	*Nil*	·51	40·59	13·93	16·96	21·60	6·76	C L_1	8
275	„ ...	6″—12″	„	·49	49·06	19·12	14·56	9·60	5·77	L_3	7
276	„ ...	„	„	·32	42·62	17·70	15·36	18·40	6·84	L_4	8
277	„ ...	1′—2′	„	·37	35·23	23·76	13·56	15·36	6·90	C L_2	7
278	„ ...	„	·03	·27	44·99	16·22	15·36	15·60	7·04	L_4	8
279	„ ...	2′—3′	·24	·40	34·65	21·11	20·16	16·96	8·95	L_5	7
280	„ ...	„	1·1	·65	43·19	16·08	14·64	13·60	10·49	L_3	8
281	„ ...	3′—4′	·83	·62	29·40	23·59	20·48	13·28	11·48	L_5	7
282	„ ...	3′—4′	·11	·23	45·94	13·71	15·52	12·08	11·76	L_3	8
283	„ ...	4′—5′	·21	·42	20·65	28·48	24·48	11·92	12·41	St L	7
284	„ ...	„	·20	·26	36·91	12·72	23·84	13·44	12·28	L_4	8
297	Bara I ...	0—6″	*Nil*	·46	39·70	22·50	19·04	14·56	7·43	L_4	9
299	„ ...	6″—12″	·04	·56	34·78	26·99	16·64	8·32	9·24	L_2	9
301	„ ...	1′—2′	*Nil*	·34	34·1	27·23	19·04	9·92	8·21	L_5	9
303	„ ...	2′—3′	·25	·30	29·01	31·70	18·72	8·48	8·78	L_2	9
305	„ ...	3′—4′	·21	·38	34·10	30·49	20·64	10·08	8·05	L_5	9
307	„ ...	4′—5′	·36	·22	29·05	34·88	18·24	7·68	9·35	L_3	9
309	„ ...	5′—6′	·30	·22	21·93	37·80	23·31	10·08	9·30	St L	9
311	„ ...	6′—7′	·34	·22	13·68	36·11	29·92	11·8	9·45	St.	9
313	„ ...	7′—8′	·20	·22	12·63	26·35	37·60	15·09	18·75	H St L	9
315	„ ...	8′—9′	·02	·28	10·98	15·55	41·44	18·08	7·46	H St L	9
317	„ ...	9′—10″	*Nil*	·25	10·04	12·66	44·32	19·68	4·18	„	9
319	„ ...	10′—11′	„	·47	27·40	14·71	35·04	13·76	9·04	L_5	9
124/1919	Bara ...	0—6″	„	0·21	43·51	19·62	15·53	17·20	...	L_4	15
126/1919	„ ...	„	„	0·52	41·21	18·88	15·20	18·56	...	L_4	16
132/1919	„ ...	„	„	0·57	40·50	22·14	14·67	18·80	...	L_4	17
128/1919	„ ...	„	0	1·29	35·78	18·70	14·60	23·52	...	...	18
130/1919	„ ...	„	·28	·89	40·19	17·19	13·86	26·20	...	...	19

Table VI.

CHEMICAL ANALYSES OF WATER EXTRACT OF SOILS FROM CHAK $\frac{138}{9\,L.}$ G. B. E. S., MONTGOMERY.

PERCENTAGE CALCULATED ON THE AIR DRIED FINE EARTH.

Register No. for 1918.	Designation.	Description.	Total soluble matter.	Alkalinity as carbonate and bicarbonate.		Diagram No.
				Sodium carbonate,	Sodium bicarbonate.	
201	Normal ...	0—6″	·196	·0042	·0966	1
202	„ ...	„	·576	·0127	·0857	2
225	Bari ...	„	·652	·0318	·1294	3
226	„ ...	„	·804	·0254	·1260	4
249	Maira ...	„	·422	·0021	·0756	5
250	„ ...	„	·568	Absent	·1361	6
273	Kalrathi ...	„	2·10	·0085	·0672	7
274	„ ...	„	1·21	·0254	·0857	8
297	Bara No. I ...	„	·748	·0276	·0756	9
298	„ ...	„	·910	·0360	·0857	10
321	Bara No. II ...	„	·852	·0699	·1025	11
322	„ ...	„	·930	·0594	·1025	12
345	Brara No. III ...	„	·808	·0551	·1361	13
346	„ ...	„	·938	·0594	·0974	14
124/1919	Bara ...	„	·582	·0233	·0857	15
126/1919	„ ...	„	·472	·0127	·0924	16
132/1919	„ ...	„	3·726	·0223	·1033	17
128/1919	„ ...	„	·500	·0382	·0974	18
130/1919	„ ...	„	1·170	·0424	·1008	19

Table VII.

CHEMICAL ANALYSES OF THE HYDROCHLORIC ACID EXTRACT OF SOILS FROM CHAK No. $\frac{138}{9\text{-L.}}$ G. B. E. S., MONTGOMERY.

Register No. of 1918.	Designation.	Description.	Per cent. on air dried fine earth.				Diagram No.
			Lime $Ca\,O$.	Magnesaim $Mg\,O$.	Iron and aluminium $Fe_2\,O_3$ and $Al_2\,O_3$.	Sulphate $S\,O_3$.	
201	Normal ...	0—6″	6·68	0 25	12·91	0·35	1
203	„ ...	6″—12″	2·13	0·47	11·44	0·25	9
205	„ ...	1′—2′	2·69	0·93	13·29	0·39	9
207	„ ...	2′—3′	1·68	0·20	12·69	...	9
209	„ ...	3′—4′	3·64	0·74	9·60	...	9
211	„ ...	4′—5′	3·75	0·39	9·13	...	9
213	„ ...	5′—6′	3·47	0·53	9·52	...	9
215	„ ...	6 —7′	3·64	10·09	10·04	...	9
217	„ ...	7′—8′	3·14	0·05	12·98	...	9
219	„ ...	8′—9′	2·61	0·02	14·11	...	9
221	„ ...	9′—10′	3·04	0·25	11·73	...	9
223	„ ...	10′—11′	3·10	0·40	14·24	...	9
297	Bara I ...	0—6″	3·16	0·06	11·23	0·09	9
299	„ ...	6″—12″	3·51	0·06	12·82	0·23	9
301	„ ...	1′—2′	4·90	0·56	12·09	0·74	9
303	„ ...	2′—3′	4·96	0·26	13·37	...	9
305	„ ...	3′—4′	3·16	0·02	12·68	...	9
307	„ ...	4′—5′	3·55	0·58	11·22	...	9
309	„ ...	5′—6′	3·70	0·83	11·41	...	9
311	„ ...	6′—7′	2·55	0·04	14·49	...	9
313	„ ...	7′—8′	2·88	0·44	16·90	...	9
315	„ ...	8′—9′	2·77	0·29	17·47	...	9
317	„ ...	9′—10′	3·75	0·52	16·38	...	9
319	„ ...	10′—11′	5·57	0·60	11·22	...	9

Table showing field operations from July 1918 *to July* 1919.

(1) References :—W = Watering.
P = Ploughing by desi plough.
R = Raja cultivator.
M = Machine cultivator.
S = Sown with crop.

(2) Machined plot = 4
Raja plot = 2·25
Desi cultivation = 1·5

Experiment.	Plot.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	Total water applied.	Special treatment.	Remarks.	Crop notes.
BARA.																		
Raja cultivation and green manuring.	79/A Rect. 1—5.	...	...	...	...	...	...	...	...	W=1 R=1	W=1 P=1	W=3	P=1	W=1	13·5″	Gypsum applied. A/1=2 tons. A/3=1 ton. A/5=½ ton.	D/2—E/2 were treated just as D/2 and E/2 of 88 below.	San sown in July. Germination poor. Will be ploughed in and wheat will follow.
Ditto ditto	79/B =1—5	...	...	...	...	...	...	...	...	W=2 R=1	P=1	W=1	P=1 W=1	W=1	11·25″	B/1=2 tons. B/3=1 ton. B/5=½ ton.	...	Guara sown. Germination poor. Will be ploughed in and wheat will follow.
Ditto ditto	79/C =1—5	...	...	...	...	...	...	...	W=1	R=1	W=1	W=1	P=1	Fallow	6·75″	C/1=2 tons. C/3=1 ton. C/5=½ ton.	...	Wheat will be sown in Rabi.
Dirto ditto	79/D =1—5	...	...	...	...	...	...	...	W=1	R=1	W=1	W=1	P=1	...	6·75″	D/1=2 tons. D/3=1 ton. D/5=½ ton.	To be sown with san.	San to be sown. Wheat will follow in Rabi.
Ditto ditto	E/79 =1—5	...	...	...	...	...	...	...	W=1	R=1	W=1	W=1	P=1	...	6·75″	E/1=2 tons. E/3=1 ton. E/5=½ ton.	To be sown with guara.	Guara to be sown. Wheat will follow in Rabi.

Machine cultivation green manuring.		88/-A1—5	...	...	...	...	M=1	...	...	...	W=1 M=1	M=1	W=1 P=1	S	W=2	16·0″	Gypsum supplied A/2=1 ton. A/4=2 tons.	...	San sown for ploughing in. Germination poor. Wheat will follow in Rabi.
Ditto	ditto	88/-B1—5	...	...	...	...	M=1	...	...	...	W=1 M=1	M=1	W=1 P=1	W=1	W=2	20·0″	B/2=1 ton. B/4=2 tons.	...	Guara sown for green manuring. Germination poor. Wheat will follow.
Ditto	ditto	88/-C1—5	...	...	...	...	M=1		...	...	W=1 M=1	M=1	W=1 P=1	Fallow for wheat.	...	8·0″	C/2=1 ton. C/4=2 tons.	...	For wheat in Rabi.
Ditto	ditto	88/-D1—5	...	...	...	...	M=1	...	...	...	M=1 W=1	M=1	W=1	P=1 W=1	S W=1	16·0″	D/4=2 tons...	D/2 was subdivided into 5 parts. Side parts received Gypsum 110 lbs. Middle received sulphuric acid 80 lbs., others remained untreated.	Same as A.
Ditto	ditto	88/-E1—5	...	...	...	...	M=1	...	...	...	M=1 W=1	M=1	W=1 P=1	W=1	S	12·0″	E/5=2 tons ..	E/2 just as above, but half weight of chemicals.	Same as B.
Cultivation machine *versus* Raja + Gypsum.		89/-E1—5	...	...	M or R = 1.	...	W=1 P=1	...	...	W=2 M or R =1.	...	W=1	P=1	P=1 W=1	S.	For machined 2·4″. For Raja 13·5.″	Gypsum E/1 =10 cwt. E/2 & E/3 = 5 cwt. each.	Machine plots = 1, 3 & 5. Raja plots = 2 and 4.	Guara and juar mixed sown. Germination patchy.
Dynamite ...	...	89/D/5	...	...	...	...	...	...	...	...	Exploded	S/ W=2 =1	W=2	...	...	...	Gypsum 1 ton per acre.	...	Sown guara on 11th April but germination poor and failed.

Table showing field operations from July 1918 to July 1919—continued.

Experiment.	Plot.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	Total water applied.	Special treatment.	Remarks.	Crop notes.
BABA—*concluded.*																		
Raja cultivation and green manuring.	78/D -1—5	...	...	...	...	...	...	...	W=1 R=1	...	W=2	W=3 S	...	...	13·5″	...	...	Sown guara, juar and mong on 2nd May 1919. Germination bad, resown.
Ditto ditto	78/E 1—5	...	...	...	...	...	...	...	W=1 R=1	...	W=1 P=1	W=3 S	W=1	...	13·5″	...	...	Ditto
Machine and canal silt ...	107 + 108 / (Wholearea)	...	...	...	...	...	...	...	...	...	...	...	...	M=1	...	...	Reserved for silt experiment.	...
Machine and Sand ..	62 whole area.	...	...	...	...	...	...	...	...	...	M=1	...	...	...	...	...	Reserved for sand experiment.	..
Machine cultivation and green manuring.	97 whole area.	...	...	...	...	M=1	...	...	...	...	W=1 M=1	W=1 M=1	...	...	8·0″	...	...	..

Cropping, Raja cultivation.	77/C (1, 2, 3).	...	W=1 P=2	W=3 P=2 S.	W=2	...	...	...	W=1 R=1	W=1	...	...	...	...	12·75″	...	Toria sown, September.	Very poor crop. Ploughed in.
	77/D (1, 2, 3).	...	W=2 P=2	S	W=2	Crop fed to cattle.	...	...	W=1 R=1	...	W=2 Sown cotton.	W=2	W=2 P=1 (Hoeing)	W=2	25·5″	Farmyard manure to cotton before hoeing at 5 cart loads per acre.	Bajra and guara sown in September. Crop poor, fed to cattle. Cotton sown in April. Germination fair. Growth quite good.	
	77/E (1, 2 & 3).	...	W=2 P=2	S	W=2	Crop fed to cattle.	...	...	W=1 R=1	...	W=2 Sown cotton.	W=2	W=2 P=1 (Hoeing).	W=2	25·5″			
	78/A (1, 2, 3).	...	W=2 P=2	Sown turnips.	W=3	W=3	W=2	Crop fed to cattle.	W=1 R=1	...	W=2 Sown Maize, guara, and mong.	W=3	W=3 Ploughed the crop.	...	34·5″	Sown turnips in September. Crop poor, fed to cattle in January. Sown maize, guara and mong in April. Crop good and ploughed in.		
Raja cultivation and green manuring.	78/B (1, 2 & 3).	...	W=1 P=1	W=1 P=1	...	...	...	...	W=1 R=1	...	W=2 Sown as A.	W=2	W=2	Rain Ploughed in.	18·0″	Sown maize, guara and mong. Crop fair, ploughed in.		
	78/C (1, 2, 3).	...	...	...	...	...	...	...	W=1 R=1	...	W=2 Sown guara juar and mong.	W=1	W=2	Ditto	12·75″	Sown juar, guara and mong. Crop fair, ploughed in.		
Machine cultivation and Gypsum.	73/B (1—5).	...	...	M=1	...	W=1 Sown wheat.	...	W=1	W=2	W=2	W=1 Wheat reaped.	M=1	W=3 P=1 (Sown juar and guara).	W=2	40″	Gypsum B/4=10 cwt. B/3=5 cwt. B/1=Sand 2″ layer in May.	Wheat germination was good, but growth stunted, See out turns. Wheat outturn :— B/1=25 srs., B/2=30 srs. B/3=30 srs., B/4=25 srs. B/5=Not machined.	
Machine *versus* Raja and Gypsum.	73/C (1—5).	...	...	M or R =1	W=1	P=1 W=1	M or R =1 W=1	S. T. Harrow =1	W=1	M or R =1	W=1 P=1	W=1	Sown juar and guara.	W=2	Machined=32″ For Raja =18″	Machined plots =C/1, C/3 and C/5. Raja plots=C/2 and C/4.	Juar and guara germination fair. Sand plot better. Bhusa about 50 seers peracre.	
Machine and green manuring.	73/E	...	...	...	...	...	...	...	...	M=1	...	...	...	...	...	...		

Table showing field operations from July 1918 to July 1919—concluded.

Experiment.	Plot.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	Total water applied.	Special treatment.	Remarks.	Crop notes.
								KALRATHI.											
Machine *versus* Raja ...	104 (C, D & E). 1—5. each line.	...	...	...	...	...	...	M=1	...	...	...	...	...	...	...	...	To be sown into green manuring crop.	
Machine *versus* Raja ...	105 A & B/1—5 105/C & D		...	...	...	...	...	R=1 M=1	...	...	...	...	...	...	...	...		
	105/E.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	To be under Raja.	
Machine and cropping ...	106/A	...	...	...	M=1	...	...	...	...	...	...	...	W=1 P=1	...	4″	...	Rice is being transplanted here.	
	106/B	...	...	...	M=1	...	...	...	...	...	...	...	W=1 P=1	...	4″	...		
	106/C				M=1													
Duplicate of 89/E & 73/C	106/D	...	...	M=1	...	...	...	R=1	...	...	...	...	...	...	...	...	Machine plots are D/1, 3, 5 Raja plots are D/2, 4.	
Machine and cropping ...	106/E	...	...	M=1	...	...	...	...	...	...	...	...	...	...	...	...		
	74/A	...	W=1 P=1	W=1 P=1	...	...	...	W=1	R=1	...	...	...	W=3 P=1 Sown fodder mixture.	W=2	12″	...	Reserved for fodder.	
(Non-experimental) Sand tibbas spread in the plots where available.	74/B	...	W=1 P=1	W=1 P=1	...	...	...	W=1	R=1	...	...	...	W=3 P=1 Sown as A.	W=2	12″	...	Ditto	

		74/C	...	W=1 P=1	W=1 P=1	W=3 Senji sown.	W=3	W=1 Bar harrow =1.	W=2	W=1	W=2	W=1 (Ploughed R=1).	...	W=2 P=1 Sown as/A.	W=2	27·5″	...	Senji removed from February to April for cattle.
(Non-Experimental) sand tibbas spread in the plots where available by baskets.		74/D	...	...	W=1 P=1	W=1 Oats sown.	W=2	...	W=1	R=1	W=2 Sown early-fodder mixture.	W=1 Bar harrow =1	W=4	W=2	...	19·5″	...	(1) Oats ploughed in during February. (2) Fodder fed to cattle. ...
Ditto	ditto	74/E/2	...	W=1 P=1	W=1 P=1	Sown turnips.	W=3	W=1	W=1	R=1	W=1	...	...	...	...	10·5″	...	Turnips fed to cattle. ...
Ditto	ditto	74/E (1, 3, 4).	...	W=1 P=1	W=1 P=1 Sown guara.	W=3	W=3	...	...	R=1	W=1	Sown fodder mixture W=2	W=4	W=2	...	27·75″	...	Fodder fed to cattle. ...

GREEN MANURING ENPERIMENTS.

Description of Experiments.

The effects of a green manure ploughed into a soil will be the following :—

(*a*) Increase in Organic Nitrogen Compounds when a leguminous crop is grown.

(*b*) Increase of humus, which will improve the texture and the moisture holding capacity of a light soil.

(*c*) Provision of food for Bacteria.

(*d*) Liberation of organic acids which may help to render available plant foo contained in the soil particles.

Fixing attention on (*a*), since the Nitrogen must be presented to the plant in the form of nitrates except in the case of plants such as rice, the technique of the cultural operations involved must bring about the nitrification of the organic Nitrogen substances contained in the green plants. Moreover, Hutchinson (Agr. Res. Inst., Pusa Bull, 63, 1916) has adduced evidence to show that under unfavourable conditions the decomposition of a crop such as San Hemp may give rise to toxic substances which may have an actual depressing effect on the yield of the subsequent crop. He has therefore proposed a method by which the fermentation processes involved in the decomposition may be controlled, and suggests that in cases where irrigation is practised, the resulting nitrates or other easily nitrifiable substances might be applied to the field in the irrigation water. By doing so the factors B, C and D partially would be removed. We have therefore to determine—

(1) The probability under the conditions of Agriculture met with in this Province, of the development of toxicity in the green manure, and

(2) The relative importance of the factors A, B, C and D above.

(3) The economic aspects of the question.—The frequency of green manuring necessary in various rotations, and the cost and return of the operations involved and shown to be most suitable.

As regards factor I, results are being collected by the Professor of Agriculture on the possible development of toxicity with the use of San and other green manures. Results in which San shows a depressing action have been met, but while we may admit the possibility of this factor coming into play, we have not yet sufficient data in order to throw light on the conditions which favour it.

Investigations into the relative importance of the factors A, B, C and D have been laid down on the following lines :—

It has been shown by Hutchinson that under the most varying conditions of employment of the green manure, nitrification has reached its maximum after the 8th to the 10th week from ploughing it. By analysis of the soil, just before sowing it is possible to arrive at an approximate figure for the total Nitrogen which has been rendered available for use by the plant. By adding equivalent quantities of artificial manures it is thus possible to compare the relative importance of the Nitrogen factor alone, with the Nitrogen factor acting along with the factors of increased humus and water holding capacity, increased bacterial food and increased availability of soil potash and phosphate.

Plots were therefore selected with appropriate controls in which varying quantities of green manure were ploughed in and which were allowed to rot for 10 weeks. Analysis of the available Nitrogen was then made and addition of equivalent Nitrogen was made to comparison plots before the sowing of wheat in all of them. The plots chosen were six feet square, isolated from surrounding soils by a layer, one foot broad and three feet deep, of broken brick. In addition to these plots green manure was ploughed in on plots of 1/10th of an acre. The experiment was duplicated on two types of soil—a light sandy soil (No. 1) and the other a stiff loam (No. 2) whose mechanical compositions are shown in table 1. The chemical analysis of the plots in which green manure was ploughed in are shown in Table 2 and the equivalent amounts of Ammonium Sulphate and Sodium Nitrate added to the small 6′ × 6′ plot are also shown. The same quantity of seed was sown in each plot. The plates show the appearance of the plots 12 weeks after sowing.

Statement I shows weight of green manure added or the equivalent quantity of artificial manure and the corresponding yield of grain and straw actual and calculated for an acre. It also shows the relative yields in terms of the controls. These figures are plotted in figure (1). It will be clearly seen that the green manure is better than the artificial manure in all cases. Increasing the application we find depressing effects with the use of artificial Nitrogen whereas with the green manure we get a regular increase in straw in both sandy and clay soils, but a rather remarkable depression in grain in the case of the intermediate quantities of green manure. Results from the large plots, as shown in statement 2, are also plotted

Explanation The black columns represent an increase or decrease in grain and straw : a column shaded with straight lines represents the proportionate *excess* increase or decrease in straw, and similarly the dotted columns in grain.

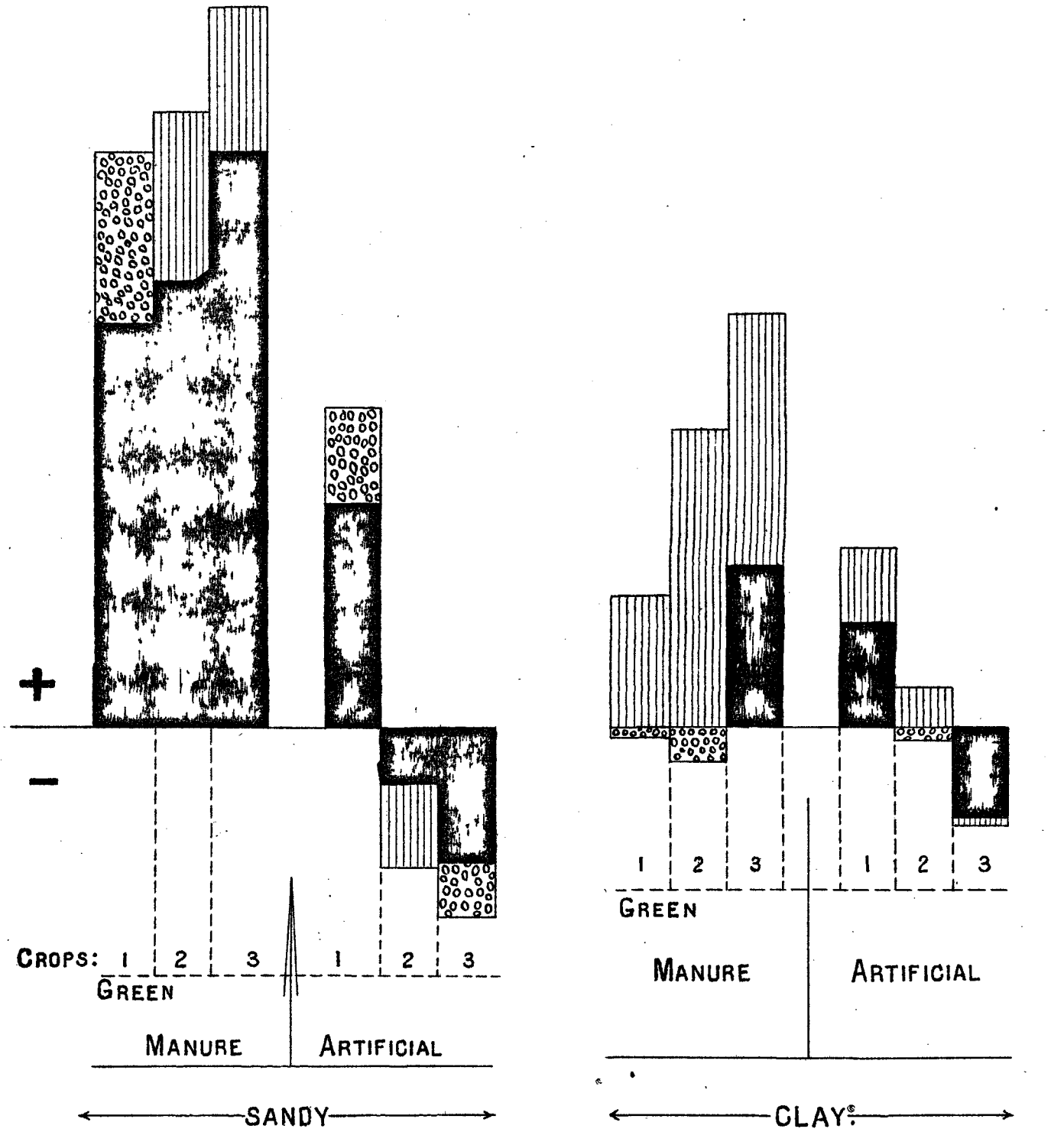
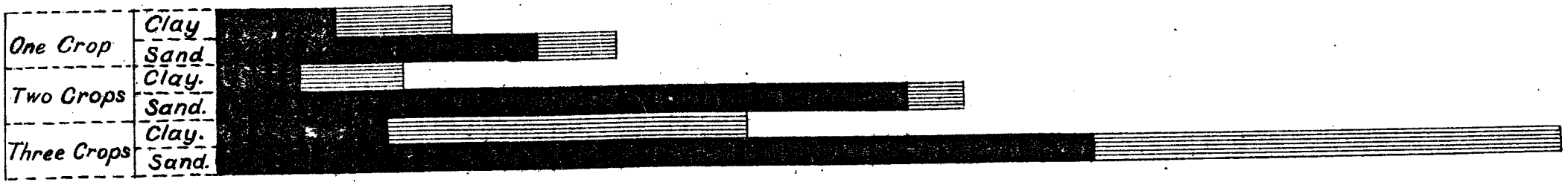


Figure 1.

Percentage increases in grain and straw from nitrogen added as Green manure and artificial. 5700-2

Figure 2.

Comparison of. Percentage increases in grain and straw, obtained by Green Manuring in stiff and sandy soils respectively.



Black Column_____Grain and Straw

Lined Column_____Straw in excess.

5700-3

in figure 2. On the whole they show similar results to those obtained on the smaller plots. It is remarkable that by green manuring in heavy soils little increase is obtained by increasing the amount of green manure added. The depression noted in the "two crop" experiments may be due to experimental error and further data will be required before any significance can be attributed to it. Increasing the quantity of green manure in both the sandy and clay plots increases the straw at a greater rate than it increases the grain. This effect has been particularly marked in the clay soil.

Regarding the question from the point of view of absolute yield, reference to the table will show that by green manuring a sandy soil which is on the limits of culturability, a yield may be obtained which is greater than that on heavy fertile soils. This must be mainly attributed to the improvement of the water retaining power of soils. All the experimental plots were treated alike, irrigation being given on 24th January, 18th March and 13th of April 1919.

The experiments will be repeated in a similar manner this year and in addition chemical examination of the experiments which have been in progress under the Professor of Agriculture will be arranged.

Table I.

MECHANICAL ANALYSIS (BY THE CENTRIFUGAL METHOD) OF 6 SAMPLES OF SOIL OBTAINED FROM THE STUDENTS' FARM. GREEN MANURING EXPERIMENTAL PLOTS.

Per cent. on airy dry fine earth.

No.	Sample.	Fine gravel.	Coarse sand.	Fine sand.	Silt.	Fine silt.	Clay.	Remarks.
	Stiff Soil.							Moisture equivalent.
1	Square 12, field 23, 1st foot.	0·34	8·24	41·32	18·63	18·70	10·96	
2	Square 12, field 23, 2nd foot.	1·92	5·29	41·99	18·90	19·00	9·36	18·14 No. II.
3	Square 12, field 23, 3rd foot.	0·32	4·43	42·89	16·48	22·60	10·00	
	Sandy Soil.							
4	Square 12, field 21, 1st foot.	0·40	36·63	44·97	5·45	6·20	4·68	
5	Square 12, field 21, 2nd foot.	*Nil.*	28·79	47·52	7·00	8·40	5·64	7·32 No. I.
6	Square 12, field 21, 3rd foot.	0·32	25·45	48·04	7·48	10·70	6·08	

Table II.

GREEN MANURING EXPERIMEMTS, 1918-19. ANALYSIS OF PLOTS AFTER DECAYING OF GREEN MANURE.

No.	Sample.	Soil.	Nitrogen % as NO_3.	Nitrogen % as NO_3.	Nitrogen % as NH_3.	Total.	Remarks.
1	Guara 1 crop ...	...	0·0042	0·00012	0·0012	0·00552	
2	„ 2 „ ...	...	0·0032	0·00016	0·0058	0·00916	
3	„ 3 „ ...	...	0·0032	0 00033	0·0023	0·00583	
4	Control ...	...	0·00024	0·00009	0·00007	0·0004	
5	Guara 1 crop ...	...	0·004	0·00016	0·00072	0·00488	
6	„ 2 „ ...	...	0·005	0·00012	0·00036	0·00548	
7	„ 3 „ ...	...	0·0025	0·00015	0·00034	0·00299	
8	Control ...	...	0·0026	0·00011	0·00018	0·00289	

Statement I.

GREEN MANURING EXPERIMENTS, STUDENTS' FARM, 1918-19.

Each plot 6′×6′

No.	Plot.	Weight of green manure put in	Dry organic matter or quantity of artificial manure.	Yield. Grain.	Yield. Straw.	Calculated amount of green manure in one acre.	Dry matter organic or artificial manure.	Yield per acre. Grain.	Yield per acre. Straw.	Proportion of grain to straw.	Per cent. increase on control. Grain.	Per cent. increase on control. Straw.	Remarks.
	SANDY.							Mds.	Mds.				
1	Guare 1 crop	21 lbs.	3·82 lbs.	9 chks.	12½ chks.	25,410 lbs.	4,622 lbs.	17·01	23·62	1 : 1·39	99·9	70·4	
2	Artificial one quantity... ...	...	Grams. Na No_3 = 258·8 / Am_2 So_4 = 49·9	7 „	10 „	Na No_3 = 690 „ / Am_2 So_4 = 133 „	...	13·23	18·90	1 : 1·43	55·4	36·4	
3	Guara 2 crop	57½ lbs.	10·45 lbs.	8 „	15 „	69,570 „	12,615 „	15·12	28·35	1 : 1·87	77·7	104·5	
4	Artificial two quantity... ...	...	Grams. Na No_3 = 199·8 / Am_2 So_4 = 249·7	4 „	5½ „	...	Na No_3 = 533 „ / Am_2 So_4 = 666 „	7·56	10·40	1 : 1·38	— 11·1	— 24·9	
5	Guara 3 crop	85½ lbs.	15·54 lbs.	9 „	16½ „	103,470 „	18,810 „	17·01	31·20	1 : 1·83	99·9	125·1	
6	Artificial three quantity	...	Grams. Na No_3 = 208·8 / Am_2 So_4 = 95·3	3 „	5½ „	...	Na No_3 = 557 „ / Am_2 So_4 = 255 „	5·67	10·40	1 : 1·83	— 33·4	— 24·96	
7	Control	...	...	4½ „	7½ „	...	...	8·51	13·86	1 : 1·63	...	...	
	STIFF LOAM.												
8	Guara 1 crop	29 lbs.	5·27 lbs.	10 chks.	15 chks.	35,130 lbs.	6,377 lbs.	18·90	28·35	1 : 1·50	— 1·72	23·21	
9	Artificial one quantity	...	Grams. Na No_3 = 90·8 / Am_2 So_4 = 22·7	12 „	16 „	..	Na No_3 = 242 „ / Am_2 So_4 = 61 „	22 68	30·24	1 : 1·33	77·9	31·42	
10	Guara 2 crop	59 lbs.	10·73 lbs.	9½ „	18½ „	71,470 lbs.	12,983 „	17·97	34·97	1 : 1·95	— 6·55	51·97	
11	Artificial two quantity	...	Grams. Na No_3 = 149·8 / Am_2 So_4 = 7·72	10	13 „	...	Na No_3 = 400 „ / Am_2 So_4 = 21 „	18·90	24·57	1 : 1·30	— 1·72	6·78	
12	Guara 3 crop	75 lbs.	13·65 lbs.		21 „	90,860 „	16,560 „	24·57	39·70	1 : 1·62	27·8	72·5	
13	Artificial three quantity	...	Grams. Na No_3 = 2·5 / Am_2 So_4 = 136·2	8½ „	10 „	...	Na No_3 = 7 „ / Am_2 So_4 = 364 „	16·07	18·90	1 : 1·23	— 16·4	— 17·8	
14	Control	...	...	10⅛ „	12⅛ „	...	...	19·23	23·01	1 : 1·20	...	...	

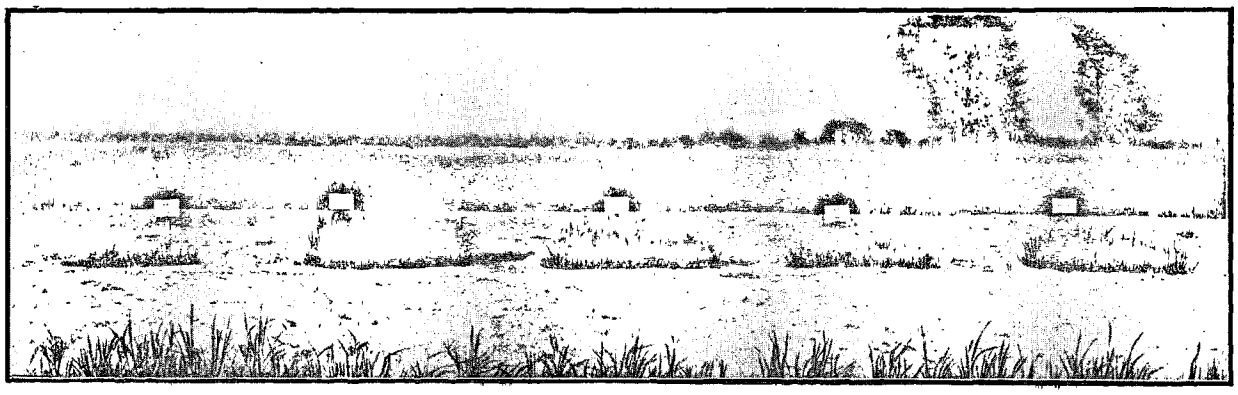
Statement II.

GREEN MANURING EXPERIMENTS, STUDENTS' FARM, 1918-19.

No.	Plot.	Weight of green manure put in.	Equal to dry organic matter.	Yield. Grain.	Yield. Straw.	Calculated amount of green manure per acre.	Dry matter organic.	Yield per acre. Grain.	Yield per acre. Straw.	Proportion of grain to straw.	Per cent. increase on control. Grain.	Per cent. increase on control. Straw.	Remarks.
	Each plot $\frac{1}{10}$th acre.			Mds. Srs.	Mds. Srs.			Mds. Srs.	Mds. Srs.		Per cent.	Per cent.	
	SANDY.												
1	Guara, 1 crop	Tons 1·6 lbs. 3,572	Tons 0·29 lbs. 649·4	1 12½	1 31	Tons 16·0 lbs. 35,720	Tons 2·90 lbs. 6,494	13 5	17 30	1 ; 1·35	58·00	71·10	
2	„ 2 „	Tons 1·94 lbs. 4,356	Tons 0·35 lbs. 792·0	1 34	2 17	Tons 19·40 lbs. 43,560	Tons 3·50 lbs. 7,920	18 20	24 10	1 : 1·31	123·00	134·00	
3	„ 3 „	Tons 4·44 lbs. 9,932	Tons 0·81 lbs. 1,806	2 5	3 20	Tons 44·40 lbs. 99,320	Tons 8·1 lbs. 18,060	21 10	35 0	1 : 1·65	156·00	237·00	
4	Control average of 3 plots ...	...	...	0 33½	1 1½	...	...	8 12½	10 15	1 : 1·25	...	...	
	STIFF.												
5	Guara, 1 crop	Tons 1·13 lbs. 2,526	Tons 0·205 lbs. 459·2	2 20	3 11	Tons 11·30 lbs. 25,260	Tons 2·05 lbs. 4,592	25 0	32 30	1 : 1·31	20·5	41·6	
6	„ 2 „	Tons 1·32 lbs. 2,962	Tons 0·24 lbs. 538·5	2 15	3 3	Tons 13·20 lbs. 29,620	Tons 2·40 lbs. 5,385	23 30	30 30	1 : 1·29	14·5	33·00	
7	„ 3 „	Tons 3·4 lbs. 7,616	Tons 0·62 lbs. 1,385·0	2 27	4 20	Tons 34·00 lbs. 76,160	Tons 6·20 lbs. 13,850	26 30	45 0	1 : 1·68	28·9	94·6	
8	Control average of 3 plots ...	...	...	2 3	2 12½	...	...	20 30	23 5	1 : 1·11	...	...	

Green Manuring Experiments.

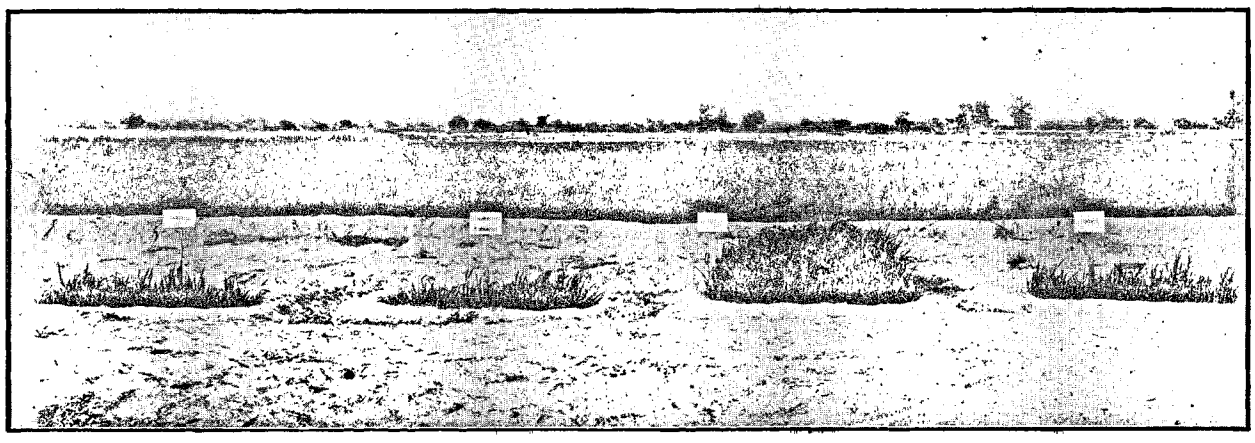
1.



Sodium Nitrate. Two Quantities. | Guara: 2 Crops. | Control. | Sodium Nitrate One Quantity. | Guara: One Crop.

SANDY SOIL: 12 WEEKS AFTER SOWING.

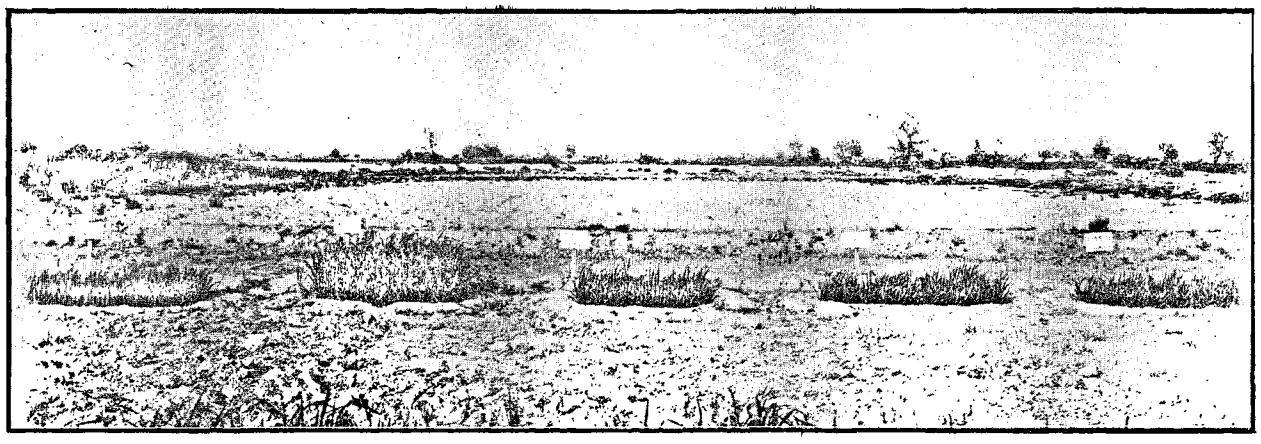
2.



• Control. | Sodium Nitrate. Three quantities. | Guara: three Crops. | Control.

SAME SOIL AS NO. 1 ABOVE.

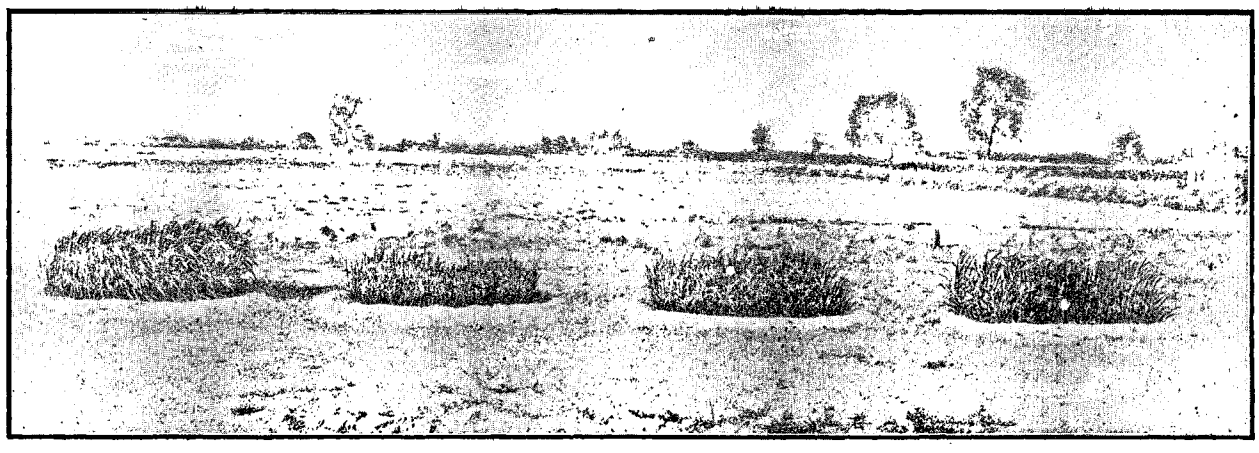
3



Control. | Guara: 3 Crops. | Sodium Nitrate: Three quantities. | Control. | Sodium Nitrate Two quantities.

CLAY SOIL: 12 WEEKS AFTER SOWING.

4.



Guara: Two Crops. | Control. | Sodium Nitrate. One quantity. | Guara: One Crop.

SAME SOIL AS NO. 3.

NITROGEN FIXATION IN THE PUNJAB SOILS.

The object of this investigation has been indicated in Part I of the Report, but further reference to its design and previous history may be added here. Results have not so far been published, and it will be a convenience to have collected together all the information relevant to the work which will be published annually in these pages. It may be remarked again, as mentioned in Part I, that it is only intended to publish here that part of the work on this subject in which the seasonal factor is predominant; the results of laboratory investigations will be published and reviewed as a whole when complete, and will only be referred to here when necessary for the explanation of other results.

The work was initiated in this laboratory by the late Mr. J. H. Barnes, when Agricultural Chemist, in May 1916. The object of the work was to determine the extent of Nitrogen Fixation which may take place in the ordinary process of the summer fallow which usually precedes the sowing of wheat. The results obtained, which are tabulated in Table I showed a surprisingly large amount of Nitrogen was added to the soil, which can only be explained by assuming that under the conditions met with, a highly accelerated rate of fixation is possible, of which there is no recorded parallel in more temperate climates. The results show an average fixation for the whole of the Punjab of 58·1 mg. of Nitrogen per 100 gs. of soil, or roughly an increase of 130% on the original total Nitrogen content.

Table I.

GIVING THE RESULTS OBTAINED IN 1916.

Locality.	Mgs. Nitrogen per 100 grams soil.			Fixation per cent.
	May.	July.	October.	
Gurdaspur Farm	60	92	100	40
Gurdaspur Nawapind village ...	53·4	34·5	99·0	45·6
Tarn Taran, Amritsar District, village Allahdinpore.	36·8	63·0	91·0	54·2
Tarn Taran, Amritsar District, Muradpur Village.	40·6	80·0	104·0	63·4
Pattoki, Chak 4	55·4	91	135	77·6
„ „ 35	29·4	81	88	58·6
Lyallpur Sandy Loam	22·8	29	127	94·2
„ Loam	39·4	48	83	43·6
„ Clay Loam	51·0	56	97	46·0
			Mean ...	58·1

In 1917 the results were repeated on a less extensive scale, and as is seen in Table 2 an actual decrease was obtained.

Table II.

TOTAL NITROGEN IN MG. PER 100 GS. OF SOIL.

Soil.	May.	August.	At Sowing.
Lyallpur	55·5	48·5	53·0
Drain gauge plot cultivated	52·5	40·5	37·5
Drain gauge plot uncultivated	53·5	45·0	34·0

An average loss of 23 %.

This result indicated that the fixation must be subject to some seasonal or other influence which may completely alter the direction of the change. It was therefore decided that in addition to the laboratory investigations which were in progress it would be necessary to continue the examination of the fluctuations of Nitrogen in soils under the variable conditions met with in the Province. The results for the year 1918 form the subject of this report; an even more extensive survey is in progress and will be continued until all the information required of the correlation of Nitrogen-Fixation with seasonal factors and cultural practice has been obtained.

Except in some cases investigated at Lyallpur the enquiry has been confined to fields on which wheat has been grown after wheat. The field set aside for experiment is sampled immediately after the harvest and is again sampled at the time of sowing. A more frequent examination of the soils is unnecessary as is shown by the curve in figure I where the fluctuation observed in Lyallpur soils are plotted (Table III) and from which it will be seen that the increase in Nitrogen is confined to the end of the fallow period. The method of sampling used may be described here. Samples were taken by means of a steel augur to a depth of 9 inches. For each field examined 10 samples were taken which were mixed to form two composite samples of five each and which were analyzed separately. The analysis was in most cases also conducted in duplicate so that the figures recorded represent a mean of four values in which both the error on sampling and the error in estimation can be detected.

The estimation is carried out by the following modification of Kjeldahl's method. The dried soil is first moistened with 2% Tartaric Acid and dried in an air oven at 100° to 110°. After thoroughly pulverising 25 grams are weighed out and transferred to a digestion flask and 30 c. c. of 6% Salicyl Sulphuric Acid added After shaking for about 15 minutes, 5 grams of Sodium thiosulphate are added and the mixture again shaken. 50 c. c. strong Sulphuric Acid are now added together with about 1·5 gram of Potassium Sulphate and a drop (about 1 gram) of mercury. The flasks are then heated till digestion is complete and the contents distilled with an excess of caustic soda, after precipitating mercury with a dilute Aq. solution of Sodium Sulphide, the distillate being received in a measured quantity of N/100 Sulphuric Acid. This is then titrated with N/100 Ammonia using cochineal as indicator. Blank controls were performed in each case.

The 'mean' error of a series of unselected duplicate determinations has been calculated by the method of mean squares. The 'probable' error of the mean of two duplicates is thus given by

$$P_m = 0{\cdot}6745 \frac{\sqrt{\times (d)^2}}{\sqrt{2}}$$

This for 16 duplicate estimation (in which error of field sampling is excluded) comes to 0·801 %. Calculating in a similar way the probable error on the determination of duplicate field samples (in which the error of estimation and of sampling is included) we get the value 1·15 %.

From the equation.

$$P_{e+s} = \sqrt{(p_e)^2 + (p_s)^2}$$

We find $p_s = \cdot 825$

Since the value for a fixation depends on the difference of two such observations the probable error will be given by

$$P_{f+} = \sqrt{2\ (1{\cdot}15)^2}$$
$$= 1.628\%.$$

From tables of the probability integral we find that for a probability of 1000 to 1 the range will be increased to $4{\cdot}9 \times 1{\cdot}628 = 7{\cdot}98$, or roughly 8.0%. That is to say it is 1,000 to 1 that the error on a single value for the fixation does not exceed 8·0%. This very certain probability exaggerates the apparent allowable error, but shows with what confidence we can rely on values which frequently exceed 200%.

N. B—

$$P_m = 0{\cdot}6745 \frac{\sqrt{(d)^2}}{\sqrt{2}}$$

$$P_{e+s} = \sqrt{(p_e)^2 + (p_s)^2}$$

$$P_1 = \sqrt{2\ (1.15)^2}$$

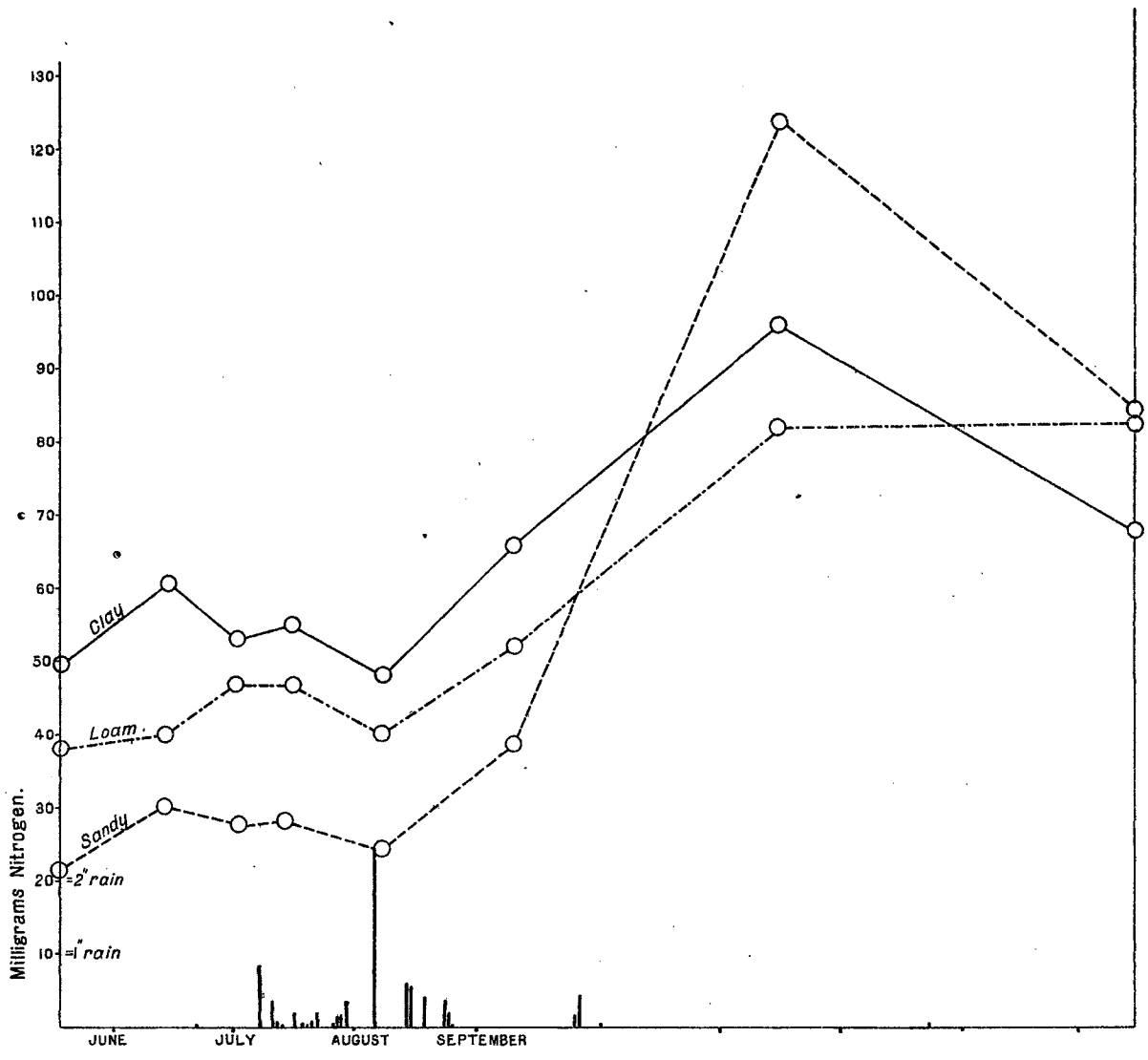


Figure 1.

Diagram showing fluctuations in Nitrogen content of Lyallpur soils, and rainfall.

5700-6

The statement in Table IV shows the district and locality from which samples were taken, a description of the soil, rainfall occurring during the period of the experiment, and the treatment the land received. It will be seen that only in five cases can we be sure that fixation has taken place, while in seven there has been an equally certain definite decrease. The average fixation for the whole Province works out at about 0·6 %. It is interesting to note, however, that the cases in which increases took place are at Hansi Farm (+16·2%) where the land was much better cultivated than in village land of the same district where the Nitrogen appears to remain about level. At Lyallpur the average for the cultivated plots is +8·1, and it is interesting to note that the highest recorded fixation, occurs in land which received most cultivation, while uncultivated land fell in Nitrogen. Similarly those cases at Lyallpur where there is an undoubted fall in Nitrogen are exactly those which received no cultivation. This correlation between good cultivation and fixation is however not supported by the results of village cultivation (compare the results of village Kaithan, Hoshiarpur District, table IV).

There is no obvious correlation between the quantity of rainfall during the period and the extent of fixation. More data will be required before any conclusions can be drawn as to correlations between fixation and *date* of rainfall, but the experiments in progress have been designed to test this point. The addition of 8·0 mg. per 10 gms. of soil of Nitrogen in a 9-inch acre is equivalent to 22·3 tons of Farm Yard Manure which contains 0·4 per cent. of total Nitrogen. Taking the average total Nitrogen content of Punjab soils, after the wheat harvest as 40 mg. the actual increase in Nitrogen which may be taken as well outside the limits of experimental error is thus 3 2 mg. which would correspond with the application of about 8·8 tons of Farm Yard Manure. The supposition which has been advanced that the connection between number of cultivations and fixation is to be referred to the droppings of the bullocks used is thus easily disposed of and at the same time an indication is afforded of the actual manurial value, with respect to combined Nitrogen of a comparatively small fixation.

Table III.

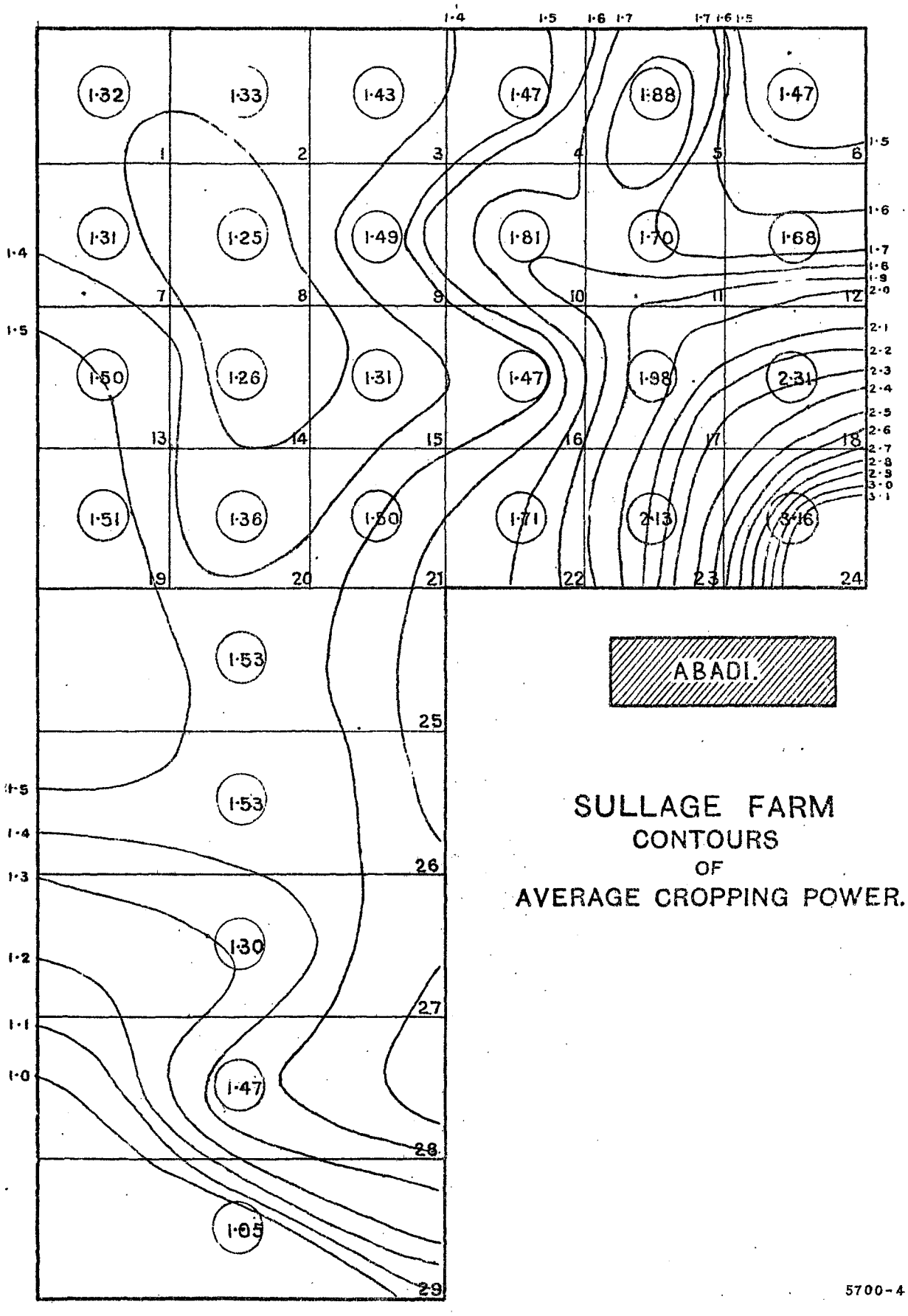
MILLIGRAMS OF NITROGEN IN LYALLPUR SOILS ON DATES SHOWN.

Date of sampling.	Sandy loam.	Loam.	Clay loam.
15th May 1916	22·8	39·4	51·0
13th June 1916	31·0	41·0	62·0
1st July 1916	29·0	48·0	54·0
17th July 1916	29·0	48·0	56·0
15th August 1916	25·0	41·0	49·0
18th September 1916	39·0	53·0	67·0
1st December 1916	127·0	83·0	97·0
	Land prepared and wheat sown.		
14th March 1917	70	84·0	69·0
	Wheat growing: harvesting to be done after a month		

Table IV.

STATEMENT SHOWING THE AMOUNT OF NITROGEN FIXED IN DIFFERENT LOCALITIES.

Locality.	Type of soil.	Treatment given to the soil between May and October 1918.			Total Nitrogen present in		Fixation per-centage.	Remarks.
		Rain-fall inches.	Irrigation number of waterings.	Cultivation.	May.	Octo-ber.		
Hissar District.								
1. Village Baha-ud-din ...	Canal-irrigated heavy loam.	5·47	1	3 ploughings ...	46·9	46·6	− 0·6	
2. Ditto ...	Ditto	5·47	1	2 do. ...	52·5	53·4	+ 1·7	
3. Ditto ...	Ditto	5·47	1	3 do. ...	54·4	54·1	− 0·5	
4. Hansi Farm, E. 17. ...	Ditto	9·42	2	13 ploughings, 7 sohagas.	42·6	49·5	+ 16·2	
Ferozepore District.								
1. Village Guru Harsahai	Barani sand ...	7·73	...	3 ploughings, 3 sohagas.	22·4	21·6	− 3·6	
2 Village Fatehgarh Korotona.	Barani light loam.	...	...	2 ploughings ...	37·1	37·4	+ 0·8	
Jullundur District.								
1. Village Alawalpur ...	Barani light loam.	11·13	...	4 ploughings ...	42·2	44·2	+ 4·7	
2. Village Dhogri ...	Barani clayey loam.	11·13	...	1 to 2 ploughings	33·3	43·6	+ 30·9	
3. Ditto ...	Ditto	11·13	...	Ditto ...	39·9	31·2	− 21·8	
Shahpur District.								
1. Sargodha Seed Farm $\frac{5}{5/8}$	Canal-irrigated heavy.	5·54	1	8 ploughings, 2 sohagas.	35·4	33·3	−5·4	
2. Ditto $\frac{11}{5/0}$	Ditto	5·54	1	Ditto	37·0	34·6	−6·5	
Lyallpur District.								
1. Agricultural Station $\frac{1-2}{1}$	Canal-irrigated loam.	5·29	2	3 ploughings, 4 harrowings and 3 sohagas.	39·6	41·8	+5·4	
2. Ditto $\frac{13}{3}$	Ditto ...	5·29	2		39·8	38·4	− 3·5	
3. Ditto sq. 10	Canal-irrigated sandy loam.	5·29	3	Not cultivated ...	42·4	37·3	−12·0	
4. Ditto sq. 10	Ditto	5·29	3	3 ploughings, 6 harrowings & 4 sohagas.	33·1	35·2	+6·3	
5. Ditto $\frac{6}{11}$	Canal-irrigated loam.	5·29	1	4 ploughings and 4 harrowings.	36·2	37·5	+3·6	
6. Ditto $\frac{6}{13}$	Ditto	5·29	1	Ditto	25·1	28·2	+12·4	
7. Ditto $\frac{C^1}{27}$	Canal-irrigated average loam.	5·29	2	7 ploughings, 3 harrowings, 7 sohagas	34·4	52·7	+21·4	Wheat after sugarcane.
8. Ditto $\frac{5}{19}$	Ditto	5·29	2	4 ploughings, 3 harrowings, 1 sohaga.	57·8	52·6	−9·1	Ditto.
9. Ditto $\frac{6}{16}$	Ditto	5·29	2	3 ploughings, 3 harrowings, 1 sohags.	57·3	49·9	−12·9	Wheat after cotton.
Gujrat District.								
1. Village Magowal ...	Barani light loam.	5·54	...	Not cultivated, covered with weeds.	25·4	27·4	+7·9	Not reliable.
2. Ditto ...	Ditto	5·54	...	4 ploughings, 2 sohagas.	17·9	17·7	−1·1	
3. Ditto ...	Ditto	5·54	...	5 ploughings, 2 sohagas.	38·8	40·5	+4·4	
Sialkot District.								
1. Badiana Farm ...	Barani light loam.	7·74	...	14 ploughings ...	26·7	24·6	−7·9	
2. Ditto ...	Ditto	7·74	...	Ditto ...	35·6	31·2	−12·4	
3. Village Raipur ...	Ditto	12·04	...	Cultivation 25·29 times.	26·4	28·0	+6·1	
4. Village Gopalpur ...	Ditto	12·04	...	Ditto	31·7	29·4	−7·3	
Hoshiarpur District.								
1. Village Kaithan ...	Barani typical loam.	12·77	...	6 ploughings, 2 sohagas.	32·2	32·8	+1·9	
2. Ditto ...	Ditto	12·77	...	5 ploughings, 2 sohagas.	51·7	48·5	−6·2	
3. Ditto ...	Ditto	12·77	...	11 ploughings, 8 sohagas.	55·0	46·3	−15·8	
4. Ditto ...	Ditto	12·77	...	6 ploughings, 12 sohagas.	37·2	32·7	−12·1	



SULLAGE FARM
CONTOURS
OF
AVERAGE CROPPING POWER.

5700-4

SULLAGE DISPOSAL EXPERIMENTS.

This work was commenced at the end of 1917 at the request of the Sanitary Board. The object of the experiment is to determine the most economical dilution for the application of sullage to Agricultural land. With a clearer knowledge of the factors influencing this figure it will be possible to decide the most suitable area per thousand of population which should be taken up for sullage disposal. It will also be possible to state the most profitable conditions of working where a municipality can supply continuous demand for irrigation water charged with sullage, either from its own pumping installations as at Amritsar, or by arrangement with the Irrigation Department. Besides the gaining of knowledge on these practical aspects it is hoped to obtain valuable scientific data on the influence of concentration on the biological processes involved in the nitrification of the organic nitrogenous substances contained in sullage.

An area of 2 acres has been provided for the purpose by the Lyallpur Municipality, and by means of a grant from the Sanitary Board tanks have been constructed from which it will be possible to supply to the experimental plots measured quantities of sullage diluted to any required extent with irrigation water. The effect of various methods of application will be tested by cropping, and at the same time biological and chemical control of the reactions taking place in the soil will be conducted by methods which have already been worked out. Unfortunately, the fertility of the land is so uneven that it has not yet been possible to commence the experiments designed. Three crops have been grown on the land with the object of exhausting as far as possible the soil. Table 1 shows the yields for each crop, from which it can be seen that the land is not yet by any means level. As it is difficult to understand the variation of the yields from the table, the average of the three crop yields is indicated for each plot, with contours drawn in, on the accompanying diagram. It will be seen that the fertility rises mountainously towards the corner adjacent to some beldars' quarters. The diagram is thus an illustration of the domestic habits of the Indian Cultivator, and of the length of time during the fertility of soil enriched with organic manures will persist, for it need scarcely be mentioned that since the land has been under experiment, no further contamination from the source indicated has been allowed to take place. As it appears hopeless to attempt to level up the land in a reasonable time by exhaustive cropping, the experiments will be started in the ensuing Rabi in such a manner that plots of low fertility will receive small applications of Nitrogen, while the weaker concentrations will be applied to plots of higher fertility. The results obtained with plots used as controls will enable correction to be made for original fertility by comparison with the results tabulated above.

Plot.	Area.	Yield in seers.	Treatment of crop.	Yield in seers.	Treatment of crop.	Yield in seers.	Treatment of crop.	Field if area were '05 acre.			Relative yields.			Average relative yields.
								Chari.	Sanwak Maize.	Wheat Bhusa.	Chari.	Maize.	Wheat.	
1	·05	160	Irrigated 29th April 1918, etc. Chari sown 7th April 1918. Harvested 21st June 1918. Irrigated 29th April 1918, etc.	162	Mixture of Sawank and maize sown 17th August 1918. Irrigated. 12th September 1918, and 28th September 1918. Harvested, 25th October 1918.	61	Wheat sown 4th December 1918. Harvested 25th January, 28th February and 2nd April 1919. Irrigated, 29th April 1919.	160	162	61	1·12	1·59	1·24	1·32
2	·05	184		165		53		184	165	53	1·29	1·61	1·08	1·33
3	·05	207		165		60		207	165	60	1·45	1·61	1·22	1·43
4	·05	225		161		62		225	161	62	1·58	1·58	1·26	1·47
5	·05	297		195		80		297	195	80	2·09	1·91	1·69	1·88
6	·05	218		178		57		218	178	57	1·53	1·74	1·16	1·47
7	·0425	158		120		51		186	141	60	1·32	1·38	1·22	1·31
8	·05	169		146		55		169	146	55	1·19	1·43	1·12	1·25
9	·05	195		159		75		195	159	75	1·37	1·56	1·53	1·49
10	·05	269		215		70		269	215	70	1 89	2·11	1·42	1·81
11	·05	305		193		62		305	193	62	2·14	1·89	1·26	1·80
12	·05	243		163		86		243	163	86	1·71	1·59	1·75	1·68
13	·0425	186		142		56		219	167	66	1·54	1·63	1·34	1·50
14	·05	150		166		54		150	166	54	1·05	1·62	1·10	1·26
15	·05	149		177		57		149	177	57	1·05	1·73	1·16	1·31
16	·05	220		171		59		220	171	59	1·54	1·67	1·20	1·47
17	·05	295		197		95		295	197	95	2·07	1·93	1·94	1·98
18	·05	281		232		132		281	232	132	1·97	2·27	2·69	2·31
19	·05	205		180		65		205	180	65	1·44	1·76	1·32	1·51
20	·05	192		164		56		192	164	56	1·35	1·60	1·14	1·36
21	·05	142		174		89		142	174	89	1·00	1·70	1·81	1·50
22	·05	185		195		94		185	195	94	1·30	1·91	1·91	1·71
23	·05	287		187		124		287	187	124	2·02	1·83	2·53	2·13
24	·05	365		313		188		365	318	188	2·57	3·11	3·81	3·16
25	·2274	770		715		416		169	157	91	1·19	1·54	1·85	1·53
26	·2274	751		815		372		165	179	82	1·16	1·75	1·67	1·53
27	·2274	690		617		330		152	136	73	1·07	1·33	1·49	1·30
28	·2274	792		552		224		174	121	49	1·22	1·18	1·	1·13
29	·2274	702		464		238		154	102	52	1·08	1·0	1·06	1·05

Experiments in Entomology and Sericulture, by Lala Madan Mohan Lal, Assistant Professor of Entomology.

I remained in charge of the section throughout and in addition to the teaching in the College which has increased very considerably the following Entomological and Sericultural work has been done :—

Entomological Work.—The numerous observations made on Insect Pests during the year cannot be given in detail here and the report is naturally restricted to the observations made on the more important pests of the crops.

I. Cotton.

1. *The cotton bollworm.*—The work on cotton bollworms was continued throughout the year. The attack remained much below normal. The highest attack in the Lyallpur Colony was :—Desi Cotton 11·8 per cent ; American Cottons 8 per cent. The average on the Lyallpur Farm remained as 2 to 5 per cent. in the desis and 0 to 3 per cent. in the Americans.

The parasite Microbracon (Roghas) appeared at Lyallpur in April and the parasite boxes were supplied to Hansi, Sargodha Colony, Lyallpur Colony, Ferozepore, Rohtak, Okara, Montgomery, Faridkot and Nabha and parasite distributing centres were established by their use. The Chief Revenue Officer, Faridkot, reported as follows :—

"The experiments made were great success in destroying cotton bollworms and thus the cotton crop was saved. The zamindars were very much interested with the excellent results of the use of these parasite boxes with which they were greatly benefited."

A few other important parasites have been reared from E. insulana as follows :—

(*i*) Small Dipterous Flies from larvæ.

These were fairly prevalent from April to May. The earlier stages of the maggot are present inside the body of the host, when full fed the maggot comes out and pupates. The pupal period takes from 7 to 9 days and the adult does not live long.

(*ii*) Big Brown Braconid. These are reared from cocoons collected from Lyallpur and Hansi. The grubs feed upon the pupæ and pass their life inside, and the adult emerges out. The life history takes about 5 weeks.

(*iii*) Black Chalcids observed during July and August. The grub and pupa stages are passed inside the body of the host in the cocoon. The adults emerge out by making a hole in the cocoon.

2. *Myllocerus blandus est.*—Since the last three years this beetle locally known as *cher kira* has proved a very serious pest on young germinating cottons in the newly opened up tracts round Khanewal. It appears in large numbers from April to May and nibbles off young shoots. Work was taken up at Piranwala to study—

(*i*) Some important points in the economics of this insect, and

(*ii*) To try on field scale the efficacy of growing maize as a trap crop.

Observations made can be briefly stated as follows :—

Food plant.—These weevils show a preference for young germinating cottons, maize and juar. They have also been found on young moth, mash and wheat.

The sequence of attack appears to be—

April.—Attack cotton seedlings. If maize is present live in leaf whorls.

May.—Up to middle of May attack young cotton then leave cotton and live on maize or juar

June.—Attack young juar (live either in the whorls or leaves or near the roots). Moth and Mash slightly attacked. Further activities and habits are being watched.

Nature of attack.—In cottons the seedling is attacked just after germination when it is bearing cotyledonary leaves. The soft tissues of the stem are gnawed off from either below the ground level or just above it and the plant dies. But when a few true leaves have appeared and the stem matures the insect cannot render fatal injury. The attack on the exposed portions is mostly carried during night or in the morning before sunrise as during day time these insects hide away from heat and light under the clods of earth, etc.

In maize and juar the insect lives generally amongst the leaf whorls eating holes in the undeveloped leaves. In bad cases of attack the central leaves along with the growing point are attacked and eaten up causing the plant to wither and die.

In moth and mash the weevils have been observed on seedlings, they bite away the stem and thus kill the entire plant.

Control.—Four different sets of experiments were started in duplicates at different localities and the necessary checks were kept. The results obtained can be briefly summarised as follows :—

Experiment I. Effect of sowing maize as trap crop before cotton.—Maize was sown in March and allowed to grow till the sowing of cotton in the fields. Very large number of weevils were found concentrated in young maize plants—and as many as 92 per cent. of the maize plants were attacked. Cotton sown in these fields after the removal of maize showed only slight attack (not more than 5 per cent. in any case).

Experiment II. Effect of sowing maize and cotton together.—Maize was sown with cotton in 2 plots and the next two plots were under cotton alone to serve as control. A very large number of figures have been collected showing the percentage of attack on the cottons of this experiment and they lead to the following conclusions :—

(*i*) Maize attracts a large number of weevils.

(*ii*) Young maize when it is about 2-3 weeks old in April appears to concentrate upon itself the maximum attack.

(*iii*) Cottons growing with maize are damaged only very slightly.

Experiment III. Effect of crude oil emulsion in the irrigation water.—When the fields were irrigated before the sowing of cotton, crude oil emulsion was mixed in the water to see whether it acts as a deterrent against the weevil. The observations showed —

(*i*) For a fortnight after treatment the 'treated' plots show much less attack than the 'untreated' plots.

(*ii*) After a fortnight of the treatment the effect of the insecticide wears away and the weevil attack appears and gradually increases in the "treated plots" as well.

Hence in order to get successful results by this method the cotton crop should receive two waterings charged with a heavy dose of the insecticide (at the rate of 6 pounds to an acre) once before the sowing of cotton and a second one a fortnight after the germination. By this method the young plants will be enabled to tide over the critical period and become sufficiently established to withstand attack.

Experiment IV. Sowing of cottons at different dates to ascertain the relative severity of weevil attack on them.—Cottons were sown in different lots at the intervals of a week each from the 15th of March to the 10th of May, and it appears from this year's observations that the time of sowing is a very important factor from the point of view of the weevil attack. Cottons sown in the middle or the last week of March or in the first week of May suffer the least, while those sown throughout April bear the brunt of the major attack. Hence if the sowings could be hurried up in March or delayed till May the severity of the weevil attack could be greatly lessened.

Various other miscellaneous methods were tested as control and some of the important ones may be given—

The use of vegetable baits—

The following baits were tried with these results :—

Bait	*No. of weevils caught on it.*
Kaddu	243
"	255
"	138
Karela	145
"	159
Brinjal	250
"	287
Green apple	86
Old Kaddu previously used	81
Old brinjal previously used	148
	1,772 weevils caught in five nights.

Light traps were used, and it was observed that weevils come in large numbers to light.

Extensive work is required to be done on the biology of this insect. Time and attention are being devoted to it and next season further experiments will be carried out on the prevention and remedial measures. The use of maize as trap crop appears to be very promising and it will be tried on a much larger scale.

3. *Other Insect pests on Cotton.*—A large number of insects have been bred from cotton and some of the important ones may be mentioned. Semiloopers from leaves have been collected from various localities and extensively reared.

(1) *Tarache catena* appears to be the commonest species.

(2) *Tarache nitidula* was obtained from Lyallpur and Montgomery Colonies.

(3) *Tarache opalinoides* was got from Kasur and Lahore.

(4) *Acontia graellsi* was found in very small number at different places. The semiloopers of Tarache SPP. were observed attacking the cotyledonary leaves of cottons and in bad cases these leaves were entirely eaten up.

Sylipta derogata, Fabr., was observed in American cottons practically everywhere. Euproctis flava and Phycita infusella were also found.

Euxoa Segetis, Sch., attacked young germinating cottons.

II. Sugarcane.

1. Last April it was reported for the first time that a bug was causing great damage to the young cane crop round about Dasuya (Hoshiarpur District).

Observations were made upon the spot and the results may be summarised as follows:—

Name of the insect.—Esmun SPP. belongs to Hemiptera Heteroptera Family Lygaedae genus Esmun.

Nature of damage.—The nymphs and adults are found together on the inside near the base of the young leaves of canes. They suck a large amount of sap which causes the leaves to wither and dry up. Leaves after leaves are attacked and in bad cases the whole plant is killed.

Life history.—In captivity eggs are either laid singly or 2 or 3 are attached together. Eggs are small, oval, with one end curved and the other end flattened. The immature wingless youngs which emerge after about a week have head and thorax dusky and abdomen bright vermilion. There are two prominent white bands in the middle of the body between the wing pads. The winged adults are black with very short hairs. Upper wings are dirty white with brownish spots on each.

Food-plants.—So far it has been found only on canes.

2. It was observed at Ferozepore that Chilo SPP. and Scirpophaga SPP. occur together as borers in young canes from April—July.

III. Monophlebus on mangoes.

The banding experiments against mealy bugs were repeated last season at Lahore. The fluffy bands of well carded cotton wool were found very effective. A good greasy mixture for banding the trees has been prepared by mixing coal tar and crude vaseline together.

The banding of trees is a measure of temporary nature because it does not aim at reducing the number of insects. In 1918 when conducting the banding experiments, we had killed off young bugs by millions by brushing them off every morning from beneath the bands, etc., where they were collected into balties containing water and oil. The effect of this wholesale destruction was manifest during the last season when the gardens treated previous year were found to be singularly free of this insect. Hence it is important to carry out a rigorous crusade for the destruction of these bugs.

IV. Euphalerus citri.

In 1918 two gardens at Sargodha were sprayed with crude oil emulsion and tobacco decoction. The trees remained free of the pest and as a result a bumperful of crop was borne on the plants and the profit was considerable as shown by following statement:—

1. Sardar Raj Singh's garden—

Year.	Income by auction of the garden.	Remarks.
	Rs.	
1915	450	Disease had not appeared.
1916	250	Disease had got a start.
1917	25	Disease had got a thorough hold.
1918	400	Results of spraying.

2. Sardar Jiwa Singh's garden—

Year.	Income by auction of the garden.	Remarks.
	Rs.	
1915	1,200	Disease not started.
1916	500	Disease just started.
1917	120	Disease had got a thorough hold.
1918	910	Results of the spraying.

Thus as a result of one season spraying the trees which were dying had regained almost their original vitality and health. Other gardens which have not been treated are growing from bad to worse, the trees are dying fast and all growth of fruit has stopped.

Gujranwala work.—In February 1919 a heavy infestation of all the citrus trees (885 in number) in the district board garden was noticed. The new shoots on the plants were dying and the flower buds were badly damaged. Spraying with tobacco wash was started in March. Ingredients for tobacco wash :—

6 seers of refuse tobacco.

1½ seer of good bar soap.

6 gallons of water.

Preparation.—Steep the tobacco in water and boil for half an hour. Cut the soap in slices, and add to the tobacco solution and boil till completely dissolved. Dilute the solution with six tins water for use.

The effect of the spraying is instantaneous. Two complete sprayings have got rid of the pest altogether and now the trees are bearing normally. The garden has been auctioned this year for Rs. 2,050 against Rs. 1,100 of the last year when there was only a slight attack of the insect.

The control of this Psylla in the gardens is not a difficult matter if a thorough spraying is done each year in February. The cost of the spraying is very little, it comes to only 3 pie. per tree while the profit by the increased yield becomes sure.

The life history.—Has been completely studied and may be briefly described here.

Eggs are laid in clusters rarely singly and always in unopened tender leaves or on flower buds. Each egg measures ·25 m.m., is oval with the tapering upper end. Young nymphs are of pale yellow colour and are of not very active habit. They feed gregariously, vigorously sucking the sap and pass white globules of sugary stuff through the annal end. After undergoing 5 moults they become adults.

A single fly has been observed to lay as many as 900 eggs and the length of the life history depends upon the season. During the hot weather it is from 15-18 days while during the cold weather it is from 30-35 days. The insect passes through 8 to 10 generations during the year.

V. Pests of vegetables.

1. The Epilechna beetles which are a serious pest of Brinjals were found breeding on Aksan plants (Withania Somnifera) and makho plants (Solanum nigrum). These two appear to be very important wild food-plants of this insect.

The grubs of Epilechna dodecastigma was found damaging tomato seedlings in nurseries.

(*ii*) Tanymecus indicus was present on china plants (Panicum miliacaum).

VI. Pests of stored gram.

Some observations were made this year on the life history and habits of pulse beetles which infest gram, mung (phaseolus mungo) and mash (phaseolus radiatus) the three principal pulses of the province. Two distinct species of Bruchus have been identified :—

Bruchus chinensis, Linn, and B. quadrimaculatus Fabr.

The last appears to be more common. There are several generations of it in the year and it is only a pest of the godowns. It does not breed in gram flour or crushed gram (known as kara) which is used for the feeding of bullocks, etc. It breeds freely in split grams used for horses.

VII. Sericulture.

Silk worm rearing was a failure throughout the Province. The eggs from France arrived in India very late. They did not give good results for—

(i) Changes of temperature on the long voyage had adversely affected them.

(ii) They could not undergo sufficient hibernation before incubation.

The result was that the hatchings were only from 15 to 20 per cent.

Four hundred and seventy-one ozs. of eggs were distributed by the Agricultural Department in the districts of Gurdaspur, Ambala, Sialkot, Hoshiarpnr and in addition 400 ozs. were given in Gurdaspur by Khan Bahadur Shaikh Ghulam Sadiq. The crop has been very poor. The results are not available yet as on account of Railway traffic difficulties all the cocoons have not been collected and sold yet.

VIII. FIELD RATS.

Work on this pest has been started. Habits of these animals, the extent of the damage they do in fields and methods to cope with them are being studied.

Habits.—They make burrows in the fields and generally live singly except for a short time after breeding. Each burrow has a main entrance with a number of rat-ways round it which vary from 2—17 over an area of 1—20 square yards. Rat-ways are all interconnected by subterranean passages, some of which end blindly. Inside each burrow there is a nest well lined with soft material like grass, cotton, lint, etc.

Damage in crops.—They do considerable damage annually to growing crops. Some rough figures of the extent of damage to wheat, cane and cotton have been collected from field observations. Experiments in the laboratory showed that each rat consumes annually on the average food worth about 8 annas. This appears to be rather a low estimate as in such experiments they pass their lives in confinement and are fed upon one kind of food only.

Control measures.—The use of various poisons has been tried.

1. Barium Carbonate mixed with wheat flour. This forms an extremely poisonous stuff but does not appear to attract field rats.

2. Datura (Datura Stramonium) and Oleander (Nerium Oleander) are extremely poisonous plants. A docoction of their seed, root and bark was prepared and mixed with flour.

3. Strychnine has been used to poison wheat grains. These grains when thrown into the rat burrows has proved effective in killing the rats.

4. Fumigation with Carbon Bisulphide in the inhabited burrows has also given very satisfactory results.

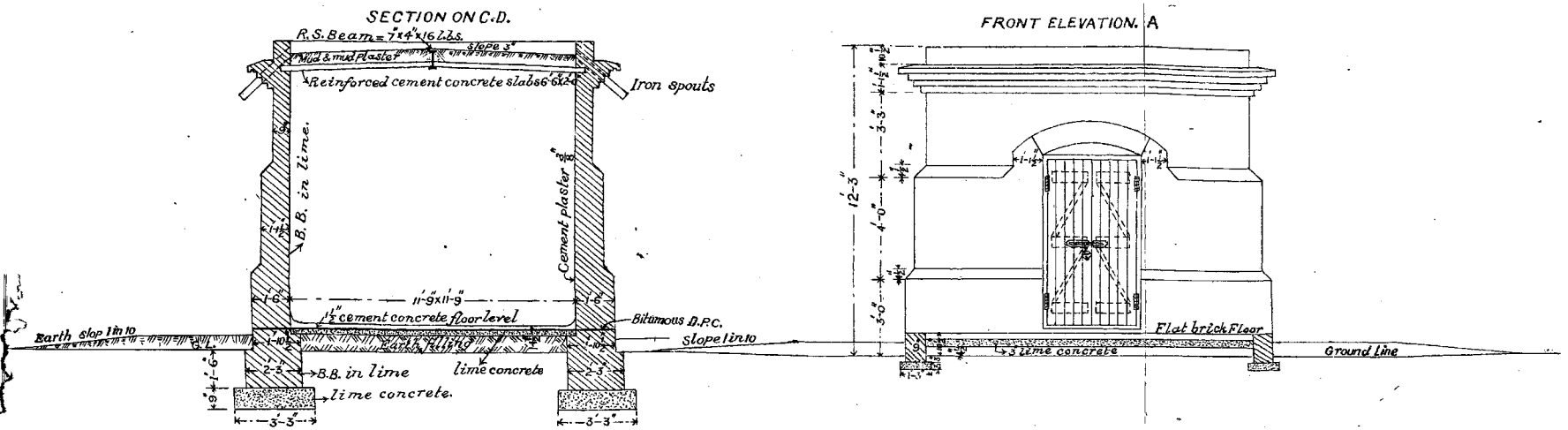
IX. In the end I acknowledge with thanks the good work done by the Entomological Assistants (Lalas Tehl Ram, Dina Nath and Umrao Bahadur) in connection with the study of Insect Pests.

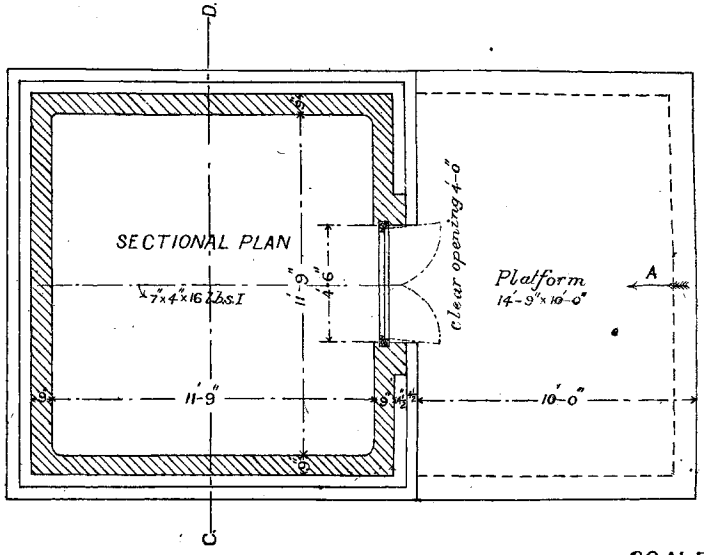
MADAN MOHAN LAL,
Assistant Professor of Entomology, Lyallpur.

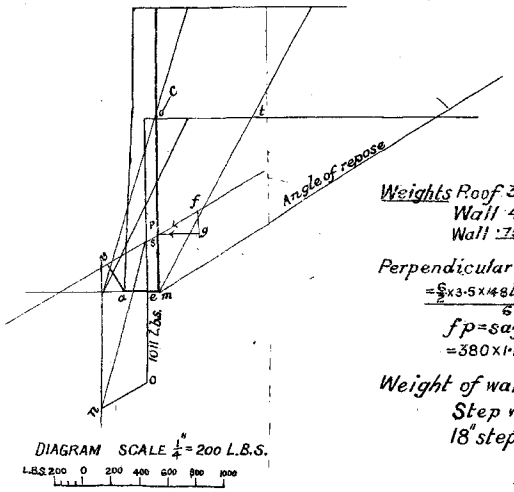
82 DA—500—17-1-20—SGPP Lahore.

DESIGN FOR A SEED GODOWN TO HOLD 400 MAUNDS

(by T. A. Miller Brownlie).







Weights Roof 3'x1 = 3 sft. @ 50 = 150
Wall 4 x 1 x .75 = 3 @ 100 = 300
Wall $\frac{.75+1.12}{2}$ x 1 x 6 = x100 = $\frac{561}{1011}$ Lbs.

Perpendicular pressure = $\frac{\text{wt of } \triangle \text{ of earth cmt x ot}}{\text{vert depth a m.}}$

$= \frac{\frac{6}{2} \times 3.5 \times 48 \text{ Lbs} \times 3.5}{6} = 294$

fp = say 380 Lbs x av
= 380 x 1.1 = 418 Lbs.

Weight of wall 1011 x l everage ea = 0.8 = 800 Lbs.
Step wall from 18" to 9"
18" step to be short.

SCALE ¼" = 1 FOOT.

12 0 1 2 3 4 5 6 7 8 9 10 11

GRAIN GODOWN.

(Sd) T. A. MILLER BROWNLIE,
C.E., M.I.W.E., M.I.M., & C.E.
Agricultural Engineer,
to Government Punjab.

S.G.P.P.

DR No 107.

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Report on the Operations of the Department of Agriculture, Punjab,

for 1919-20.

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REPORT

ON THE OPERATIONS OF THE

DEPARTMENT OF AGRICULTURE, PUNJAB,

FOR THE YEAR ENDING 30TH JUNE 1920.

PART II.

Annual Experiment Record.

LIBRA... OF T... BO... ER... ROYAL

Lahore:
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRINTING, PUNJAB.
1921.

PART II.

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Annual Report of the Professor of Agriculture, Punjab, Lyallpur, for the year 1919-20.

LYALLPUR AGRICULTURAL STATION.

Introductory.—I was in charge of the Agricultural Station throughout the year.

2. *Season.*—The rainfall for the year totalled 9·89″ as compared with 8·14 for the previous year and an average of 11·09 for last 5 years and 14·05 for last 10 years (Statement I). It will be seen that rainfall stopped after August and the season was critical for American Cotton where canal water happened to be deficient. The large area of cotton sown and the dryness of the air accentuated the difficulty, while the whole crop including Deshi suffered, the damage was more serious in case of American and especially in Lyallpur and Gojra. The Farm suffered almost worse than any one. In spite of all this the American Cotton crop on the whole did very well in the colonies and a total crop of over 2 lakhs of bales was produced. The season was very favourable for sugarcane which ripened well everywhere. The Rabi season was the best we have ever experienced and yields of wheat have been 10 maunds per acre higher than the highest record obtained so far which was 33 maunds in 1916.

3. *Experiments on the Farm: all on irrigated land.*—(Note.—Average yields are calculated per acre.)

Varietal and other experiments in Area C, Square 27.

Sugarcane.—Testing varieties of cane, *viz.*, Lalri and Suretha against Katha as standard.

The average yield of gur per acre works out as follows :—

	Mds.	Srs.	Ch.
Katha (4 plots)	54	5	0
Lalri (3 plots)	54	15	0
i.e., practically no difference.			
Katha (3 plots)	52	15	0
Suretha (3 plots)	64	6	0

or an increase of nearly 12 maunds per acre in favour of Suretha. The latter is a United Provinces Cane and is grown to some extent at Karnal and had been reported favourably upon at Gurdaspur. It is thicker than "Katha" and the results are interesting in view of the fact that all cane was attacked by borer and was not promising to start with. The average of Katha in 7 plots comes to 53 maunds 15 seers or one maund per acre less than Lalri. Only 4 plots were contiguous and their yield only has been taken above in comparison with Katha and Lalri (Statement II).

Sugarcane varieties with tenants.—Eighteen plots of which 10 were under Katha as standard and 4 each under Lalri and Suretha. Results confirm those under direct cultivation except that yield of Lalri averages slightly better than on the Farm. Yields were highest so far obtained on the Farm (Statement III).

CULTURAL EXPERIMENTS.

Harrowing versus *no Harrowing with wheat.*—Harrowing was only done directly after sowing—results 20 seers in favour of non-harrowed plots. Yields very high throughout (Statement IV).

Different methods of sowing maize.—One of the line plots being adjacent to early maize suffered severely from borer attack. Results favour "Kera" or ordinary method (see Statement V).

Different methods in tenants' area.—Confirm above—Yields poor (Statement VI). Outturns of Senji (Melilotus Parviflora) after maize (see Statement VII—no experiment).

Cultural experiments with wheats.—Results as last year slightly in favour of deep ploughing—Statement VIII—see paragraph 8 of last year's report.

Hot weather versus *Rain ploughing for wheat.*—Yields in favour of rain ploughing. Failure of rains after August probably accounts for this as it is contrary to average of previous years (Statement IX).

Ridging versus *flat lines sowing for American* (4-F.) *in square* 26.—The crop did fairly well up to middle of August after which it suffered severely. This land does not seem to be in a condition to grow cotton under present rotation. Ridged plots gave 2 maunds 9 seers and unridged 2 maunds 8 seers per acre—see Statement X.

Cotton in lines versus *broadcast with tenants.*—Results show advantage of line sowing and interculture, confirming all past experiments (see Statement XI).

Ridging maize versus *flat.*—Twenty plots of which 10 were ridged and 10 flat. Plants badly attacked by borer—results 9 seers per maund in favour of ridging but difference is too small to be of any importance—Statement XII.

Irrigation experiments.—In square 10—waterings before July and after July.

American crop poor practically throughout the Farm and results indefinite but showing as in previous years that one or two waterings before July is ample. In case of waterings after July indications are in favour of frequent waterings (Statements 13 and 14). In square 32 above results as to watering before July confirmed (Statement 15). Similarly frequent watering after July indicated in Statement 16.

No watering till July versus *ordinary watering with tenants.*—Results show slight advantage of ordinary watering over "no-watering" (Statement 17). With 285-F the results are in favour of "no-watering." The yield being 22 seers per acre more on the average of 8 plots (see Statement 18).

Hydraulic experiments with wheat—In square 10 effect of 3 *versus* 2 irrigations after sowing with "early" and "late sown" wheat was tested. Results with "early sown" show 1 maund 6 seers in favour of 3 irrigations.

With late sown there was a difference of 2 maunds 30 seers in favour of 3 irrigations. The first two irrigations were given at the same time as in case of early wheat. The 3rd irrigation alone had very little effect (Statements 19-20).

Hydraulic experiments with Toria.—In square 10 the results show 28 seers in favour of two irrigations as compared to one for Toria in case of the "early sown" crop. With "late sown" one irrigation gave 27 seers per acre more on the average (see Statements 21 and 22).

Toria varieties.—As has been stated Mr. Faulkner had been working on the separation of types from the mixed Toria crops at present grown. Sufficient seed was not available to test pure types on a large scale but the "early" and "late" types were tested in general. In square 26 the yields are in favour of "early toria" being 2 maunds higher in case of non-harrowed plots and 24 seers in case of harrowed. Harrowing appeared to depress the yield in this case, the yield being 1 maund per acre higher in non-harrowed plots. In square 27 the early variety is better by 1 maund 11 seers average of 12 plots (see Statements 23-24).

In square 43 "early," late and local were tried in 18 plots and results confirm higher yielding qualities of "early" types. Harrowing in this case was beneficial. With tenants results are slightly in favour of late variety.

Harrowing was slightly beneficial (see Statements 25-26).

MANURIAL EXPERIMENTS.

With 4-F. Cotton in square 27, Area F 1.—Results show beneficial effect of complete manure (see Statement 27).

With 4-F. Cotton in square 27, Area F 2.—Confirm above. In one case of complete manuring yield of 20 maunds 30 seers obtained with 4-F. (Statement 28).

Green manuring.—Area C—square 2.—Guara *versus* fallow shows an increase of 5 maunds and 4 seers in favour of Guara, the land is poor and Kallarathi (Statement 29).

San and Guara versus *Guara removed in tenants' area.*—Indicate harmful effect of removing Guara as it depresses yield 9 or 10 maunds in this experiment (see Statement 30).

Fallow versus *"early" and "late" green manuring with Guara in tenants area.*—Results indicate that late "green manuring" is more beneficial but the matter is of practical importance as water is often available in May and June and hence point should be studied further (Statement 31).

Nitrate of Soda with wheat—(Square 7).

These plots have grown wheat continuously for 10 years. There was a profit in both "heavy" and "moderate" application of "Nitrate" (Statement 32).

Varietal tests of 8-a and No. 11.—These varieties were tested altogether in 200 plots, *viz.*, 100 of No. 11 and 100 of 8-a. The tests were conducted for "early" and "late sown" with 2 or 3 irrigations respectively and in various classes of land. They indicate clearly the superiority in yield of No. 11 and will be discussed separately as follows:—

Early sown wheat in square 26.—Comparison of 8-a and No. 11. Average of 12 plots show 2 maunds 2 seers per acre higher average yield for No. 11 (Statement 33).

Late sown wheat in square 26.—Comparison of 8-a and No. 11. In these plots wheat followed wheat and this combined with late sowing depressed yield very considerably. Results 42 seers per acre in favour of No. 11 (average of 8 plots only 4 ruled out) (see Statements 33 and 34).

Comparison of early and late sown wheat 8-a and Punjab 11 in new Area.

Early sown.—With 2 irrigations—13 plots—average yield per acre 22 seers in favour of No. 11 (Statement 35).

Early sown with 3 irrigations shows 1 maund 23 seers in favour of No. 11 on an average of 18 plots. Late sown—2 irrigations in 18 plots—average yields works out 1 maund 4 seers in favour of 8-*a* (Statement 36). Late sown with 3 irrigation in 18 plots—average yield per acre 7 seers in favour of No. 11 (Statement 36).

Tests in tenants' area.—8-a and No. 11 early sown with 3 irrigations on good land. Average of 16 plots shows 14 seers in favour of 8-*a* (Statement 37).

8-2 *and No.* 11 *with* 2 *irrigations on good land*—(Early sown).

The average shows 36 seers per acre in favour of No. 11 (Statement 38).

8-*a and No.* 11 *with* 2 *irrigations on light land with* 3 *irrigations.*—The average of 12 plots shows one maund 17 seers in favour of No. 11 (Statement 39).

8-*a and No.* 11 *on light land with* 2 *irrigations*—The average of 12 plots in favour of 8-a by 1 maund 25 seers per acre (Statement 40). Late sown wheat 8-*a* and No. 11 on good land with 2 irrigations show 7 seers in favour of No. 11 on an average of 16 plots (Statement 41)

8-*a* and No. 11 with 3 irrigations shows 13 seers in favour of No. 11 (Statement 42).

Similar tests on light land gave following differences.—(*a*) With three irrigations there were 17 seers in favour of No. 11 (Statement 43).

(*b*) With two irrigations the difference was 1 maund 7 seers in favour of No. 11 (average of 12 plots in each case) (Statement 44.)

On the whole No. 11 yielded better by 14 seers per acre on the average of 102 plots of each variety. The results obtained at Montgomery though not quite so reliable confirm this. Out of the 14 series of tests at Lyallpur No. 11 is better in 11 of these and No. 8-*a* in 3 only

Comparison of 8-*a and No* 17—As the grain of 8-*a* is liked by some zamindars and it may thus compete with No. 17 which is grown mainly for local consumption of which the estimated area is over 2 lakhs of acres. A test was carried out in 16 plots in fair average land. The average shows No. 8-*a* to have done better by 23 seers per acre. A more extended test will be conducted in the coming season (Statement 45).

Type 11 *and Imp. Economic Botanist's N..H. 4 y P* 6.—Only 4 plots were utilized—the result shows 1 maund 14 seers in favour of No. 11 (Statement 46).

Comparison of yield of barley varieties.—Nos. 1, 2 and 5 were handed over by Economic Botanist last year. Results are as follows :—

Local.		*Mds.*	*Srs.*	
22—30	24—12 (No. 5)	1	22	Increase.
18—26	24—36 (No. 2)	5	30	Increase.
23—35	18—2 (No. 1)	5	35	Decrease.

The average of local barley on 6 plots was 21 maunds 30 seers. No. 2 is very promising and will be tested on a larger scale. The land is uneven and much value should not be attached to above results (Statement 47).

Gram varieties.—Nos. 7, 17, 15 and 20 were handed over last year but only given a preliminary test then. A larger test was made this year. All have yielded more than the local (see Statements 48-51).

Comparison of 285 *and* 4 *F. under different watering conditions.*—Comparison of No. 285-F. and 4-F. in tenants' area all plots given liberal waterings varying from 4 to 8 in number as land and condition of crop demanded. As previously pointed out the season was very unfavourable for American Cotton and particularly for 4-F. which has large leaf surface and more spreading habit than 285-F. The average of 14 plots of each show 18 seers in favour of No. 285-F. (Statement 52).

Comparison of 285 *and* 4-*F. with less waterings.*—Shows still more favourable for No. 285 which gave 1 maund 23 seers per acre more. Yields throughout are poor (Statement 53).

Comparison of Mollisoni and Farm selected broad leaf.—Yields on 12 plots of each confirm previous results. Mollisoni was better by 1 maund 9 seers this year. *Note.*—High yields of Deshi Cottons as compared to American this year (Statement 54).

Mollisoni and K 22 (*Leake's Cawnpore selection*).—Result overwhelmingly in favour of Mollisoni. No more K 22 will be grown (Statement 55).

4-F. and Risala American and selections No. 1, etc. See Statements 56 and 57. Selection No. 1 shows some promise.

American and Deshi selections.—Only small plots or a few lines were grown and acre yields are misleading. The American imported varieties were almost or complete failures (Statement 58).

Row to row test of 4-*F. and* 285-*F. in sq.* 29.—See Statement 59 which shows 285 to be better by 1 maund 4 seers per acre.

Outturn of Mangel Wurzel.—Square 26, Area D. Three plots received 8 and three 5 waterings only.

	Maunds.	*Seers.*
Average yield of heavier watered plots	691	8
Average yield of less heavy plots	626	7

or a difference of 65 maunds in favour of heavier waterings. The yields averaging over 20 tons per acre would be regarded as good at home (Statement 60).

Different number of irrigations for wheat.—Very small plots were used but results interesting as showing comparatively little effect of waterings in excess of two though the highest average yield is given by plots with five watering (Statement 61).

W. ROBERTS,

Professor of Agriculture, Punjab, Lyallpur.

Statement No. 1.

SHOWING RAINFALL AT THE LYALLPUR AGRICULTURAL STATION DURING THE YEARS 1918-19 AND 1919-20.

Name of month.	Rainfall during 1919-20.	Rainfall during 1918-19.	Remarks.
June	...	·09	
July	2·59	·82	
August	5·17	3·29	
September	...	·57	
October	...	·16	
November	...	...	
December	·87	·43	
January	·57	1·27	
February	·21	·27	
March	·26	·26	
April	...	·26	
May	·22	·72	
Total ...	9·89	8·14	

Average rainfall for the last 5 years ... ... 11·090
Average rainfall for the last 10 years ... ... 14·051

Statement No. 2.

OUTTURNS OF SUGARCANE GROWN IN ROTATION SERIES, AREA C, SQUARE 27, KHARIF 1919.

Square and plot.	Sub-plot.	Variety of cane.	Area in acres.	Weight of green tops. Maunds.	Weight of green tops. Seers.	Weight of cane. Maunds.	Weight of cane. Seers.	Weight of juice. Maunds.	Weight of juice. Seers.	Weight of gur. Maunds.	Weight of gur. Seers.	Yield of gur per acre. Maunds.	Yield of gur per acre. Seers.	Per cent. of green tops to cane.	Per cent. of Juice to cane.	Per cent. of Gur to juice.	Per cent. of Gur to cane.	Date of watering.	Remarks.
27 C2	1	Katha ...	1/10th of an acre.	..	...	11	37	27	33	5	29 6/16	45	35	30·3	52·6	20 6	10·8	26th March 1919, 25th April 1919 9th May 1919, 25th May 1919, 1st June 1919, 18th June 1919, 29th June 1919, 4th July 1919, 16th July 1919, 25th July 1919, 13th August 1919, 5th September 1919, 17th September 1919, 30th September 1919, 18th October 1919, 25th November 1919, and 21st December 1919.	Cane Borer did serious damage in early stages. Lalri suffered most of all, while Katha suffered least of all.
				12	17	40	36												
	2	Lalri ...		17	0	46	7	27	1	5	23	44	24	36·8	58·5	20·6	12·07		
	3	Katha ...		19	16	52	7	28	15	5	26¼	45	10	37·1	54·3	19 9	10·8		
	4	Suretha ...		20	16	58	25	36	18	7	29	61	32	34·7	62·1	21·1	13·1		
	5	Katha ...		20	38	53	36	32	26	6	24¾	52	38	38·8	60·5	20·2	11·7		
	6	Lalri ...		20	15	65	6	35	34	7	7¾	57	22	31·2	55·02	20 3	11·04		
	7	Katha ...		22	14	71	32	37	39	7	7¼	57	18	31·1	52·8	18 9	10·0		
	8	Suretha ...		18	0	80	12	47	31	9	19½	75	36	22·4	59·4	19 8	11·8		
	9	Katha ...		17	27	66	17	39	27	7	28½	61	28	26·6	59·7	19 4	11·6		
	10	Lalri ...		20	7	69	13	39	6	7	25	61	0	29·1	56·4	19·4	10·9		
	11	Katha ...		17	2	63	23	34	4	7	0	56	0	26·8	53·6	20·5	11·0	Same as above with the exception of 1st watering.	
	12	Suretha ...		14	27	55	30	32	12	6	34	54	32	26·3	57·9	21·2	12·2		
	13	Katha ...		16	12	59	30	32	22	6	32¼	54	18	27·2	54 4	20·9	11 3		

	Total area.	*Total yield of Gur.*	*Yield of Gur per acre.*	*Yield of stripped cane per acre.*
		Mds. Srs. Chs.	Mds. Srs. Chs.	Mds. Srs. Chs.
Katha ...	7/10	46 28 6	53 15 4	480 20 9
Lalri ...	3/10	20 15 12	54 15 5	481 29 5
Suretha ...	3/10	24 2 8	64 6 10	519 5 5

Ploughing 1
Harrowings 4
Sohagings before sowing 6
Date of sowing—13th and 14th March 1919.
Sohagings after sowing 2 in northern half and 1 in southern half.
Hoeings—Bar harrow 6 times in southern half and 7 times in northern half.
Baguri and Kasoli hoeings 6
Crushing commenced on 21st January 1920.
Crushing finished on 25th February 1920.

Statement No. 3.

RESULTS OF VARIETY TEST WITH SUGARCANE IN TENANTS' AREA, YEAR 1919-20.

No. of square and plot.	No. of sub-plot.	Variety of cane.	Treatment.	Area in acres.	Weight of Green tops. Maunds.	Green tops. Seers.	Cane. Maunds.	Cane. Seers.	Juice. Maunds.	Juice. Seers.	Gur. Maunds.	Gur. Seers.	Yield of gur per acre. Maunds.	Yield of gur per acre. Seers.	Yield of gur per acre. Chataks.	Percentage of green tops to cane.	Percentage of juice to cane.	Percentage of gur to juice.	Percentage of gur to cane.	Number of irrigations with dates.	Number of hoeings with dates.	Weight of canes required to make 1 lb of gur.	REMARKS.
13	1	Local cane	Was sown after sanji in maize which was ordinarily manured with farmyard manure.	77/720	21	17	55	23	31	32	5	17	50	29	2	38·55	57·21	17·05	9·76	Fourteen on— 4th May 1919. 26th May 1919. 3rd June 1919. 14th June 1919. 3rd July 1919. 16th July 1919. 17th August 1919. 30th August 1919. 12th September 1919. 24th September 1919. 6th October 1919. 16th October 1919. 21st November 1919. 3rd December 1919.	Ten on— 23rd March 1999. 28th March 1919. 30th March 1919. 6th April 1919. 15th April 1919. 22nd April 1919. 11th May 1919. 8th June 1919. 9th June 1919. 19th June 1919.	10·2	
13	2	Lalri		77/720	22	37	61	32	35	26	5	37	55	16	2	37·09	57·68	16·61	9·58			10·4	
	3	Local cane		77/720	24	27	56	33	32	4	5	14	50	1	1	43·42	56·48	16·66	9·45			10·6	Germination fairly good. Borer did slight damage.
	4	Suretha		77/720	21	38	65	10	37	8	6	32	63	23	6	33·64	57·01	18·27	10·42			9·5	Dead hearts were not removed. Lodging occurred badly on account of the crop being heavy and rather thin.
	5	Local cane		77/720	23	23	56	15	29	27	5	22	51	35	13	41·81	52·62	18·70	9·84			10·1	
	6	Lalri		17/180	18	1	53	4	28	18	5	10	55	23	8	33·94	53·67	18·45	9·88			10·1	Date of sowing—22nd March 1919.
	7	Local cane		17/180	21	6	46	31	26	18	4	30	50	11	12	45·14	56·36	17·99	10·13		8th June 1919.	9·8	Date of crushing—From 9th December 1919 to 2nd January 1920.
	8	Suretha		17/180	17	31	54	9	32	22	6	13	66	38	13	32·77	60·02	19·43	11·66		9th June 1919. 19th June 1919.	8·5	
	9	Local cane		1·0/2·3	20	23	43	14	23	38	4	16	50	3	7	47·46	52·93	19·17	10·14			9·8	
16/19	*1	Local cane	No manure was directly applied. Was sown after sanji in maize manure.	2,880/77/720	21	12	54	18	28	27	5	22	51	35	13	39·39	52·66	19·35	10·19	Fourteen on— 3rd May 1919. 26th May 1919. 3rd June 1919. 15th June 1919. 2nd July 1919. 16th July 1919. 18th August 1919. 29th August 1919. 12th September 1919. 28th September 1919. 7th October 1919. 15th October 1919. 17th November 1919. 3rd December 1919.	Eleven on— 23rd March 1919. 29th March 1919. 1st April 1919. 5th April 1919. 7th April 1919. 16th April 1919. 21st April 1919. 9th May 1919. 10th May 1919. 6th June 1919. 9th June 1919. 19th June 1919.	9·8	
	*2	Lalri		77/720	18	9	55	28	31	28	6	1	56	13	8	32·72	56·91	19·00	10·81			9·2	
	3	Local cane		77/720	22	12	62	37	33	20	5	34	54	29	1	35·43	53 23	17·46	9·29			10·7	Germination fairly good. Borer did slight damage.
	4	Suretha		77/720	19	12	69	23	42	15	7	31	72	28	1	27 69	60·69	18·34	11·15			8·9	Dead hearts were not removed. Lodging occurred badly on account of the crop being heavy and rather thin.
	5	Local cane		43/360	25	15	62	20	36	4	6	10	52	13	0	40·6	57·76	17·31	10·00			10·0	
	6	Lalri		43/360	20	31	71	22	38	9	7	5	59	16	1	29·03	53·42	18·63	9 25			10·0	Date of sowing—23rd March 1919.
	7	Local cane		43/360	23	11	62	36	35	4	6	25	55	18	9	35·41	55·80	18·87	10·53			9·4	Date of crushing—from 3rd January 1920 to 22nd January 1920.
	8	Suretha		43/360	21	14	79	5	47	26	9	10	77	17	11	26·98	60·22	19·41	11 69			8·5	
	9	Local cane		317/2,880	24	8	55	17	29	21	5	30	52	9	9	43·63	53 27	19·47	10·37		9th June 1919. 19th June 1919.	9·6	
					Average yield per acre.																	Average weight of cane per 1 lb of gur.	Average of gur per acre calculated on yield per acre. Maunds. Seers. Chataks.
		Local cane		307/288	...	...	...	...	...	...	55	20	52	2	9	...	...	...	...	...	...	10·	51 38 10
		Lalri		77/180	...	...	...	...	...	...	24	13	56	34	8	...	...	...	...	...	...	9·9	56 29 13
		Suretha		77/180	...	...	...	...	...	...	30	6	70	12	11	...	...	...	...	...	...	8·8	70 7 0

*The land under these strips $\frac{16}{19}$ 1, 2 was inferior to other strips of the same field. The crop was also somewhat thinner here. No. 2, that is Lalri, also suffered for about a tin of juice on account of the mill being loose for about 8 hours a night time.

Statement No. 4.

RESULTS OF HARROWING *VERSUS* NO HARROWING ON WHEAT GROWN IN ROTATION SERIES, AREA C, SQUARE 27, RABI 1919-20.

No. of plots	No. of sub-plot.	Variety.	Treatment.	Area in acres.	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Dates of watering.	Remarks.
27 C-3	1	Wheat Punjab type XI.	No harrowing	One-fourth of an acre.	8	37	4	18	18	12	35	29	0	73	35	0	21st December 1919 and 5th March 1920.	Harrowing was done only once immediately after sowing. There were showers of rain after the first irrigation and the crops grew too tall to be harrowed by the time the land was in "wattar." Plots 1—4 lodged very badly, 5—8 plots were irrigated once only, on 21st December 1919, but they also lodged cent. per cent. after a wind storm as growth was very heavy all along.
	2		Harrowing		9	9	0	20	25	0	36	33	0	81	20	0		
	3		No harrowing		9	14	2	20	23	14	37	16	8	82	15	8		
	4		Harrowing		9	5	12	16	38	4	33	23	0	67	33	0		
	5		No harrowing		10	8	12	21	23	4	40	15	0	85	13	0	21st December 1919.	
	6		Harrowing		9	25	4	19	20	12	33	21	0	78	3	0		
	7		No harrowing		9	10	8	21	19	8	37	2	0	85	38	0		
	8		Harrowing		9	5	10	20	4	6	36	22	8	80	17	8		

	Grain per acre. Mds.	Srs.	Chks.	Bhusa per acre. Mds.	Srs.	Chks.
Average yield per acre of plots Nos. 1, 3, 5 and 7 (non-harrowed plots)	37	25	10	82	5	6
Ditto ditto Nos. 2, 4, 6 and 8 (harrowed plots)	37	5	10	77	8	6

Ploughings 7 in southern half and 6 in northern half—

	Southern.	Northern.
Harrowings	10	12
Sohagings	8	6

Surface harrowing and weeding to plots 2, 4, 6 and 8—1.

Sown on 10th November 1919 and harvested on 28th April 1920 to 6th May 1920.

Statement No. 5.

RESULTS OF DIFFERENT METHODS OF SOWING MAIZE IN ROTATION SERIES AT L. A. S., KHARIF 1919.

Square and plot.	Sub-plot.	Variety.	Treatment.	Area in acres.	Weight of dry stalks. Maunds.	Weight of dry stalks. Seers.	Weight of fresh cabs. Maunds.	Weight of fresh cabs. Seers.	Weight of dry cabs. Maunds.	Weight of dry cabs. Seers.	Weight of grain. Maunds.	Weight of grain. Seers.	Yield per acre. Maunds.	Yield per acre. Seers.	Dates of irrigations.	Remarks.
27 / C-1	1	Red local maize.	'Kera' sown by hand behind the country plough.	½	20	25	21	18	16	20	13	9	26	18	6th September 1919. 27nd September 1919. 6th October 1919 18th October 1919.	There was a heavy attack of borer, but plot No. 2 suffered comparatively more than the rest, being adjacent to plot A-2 having early maize with heavy attack of borer. Crows also did damage to the crop and made the results less reliable.
	2		Lines 2' apart ...	½	16	32	20	3	15	26	12	9	24	18		
	3		Same as 1 ...	½	22	4	25	34	21	1	16	20	33	0		
	4		Same as 2 ...	½	15	0	20	28	16	30	13	15	26	30		

CULTIVATION.

					Mds.	Srs.	Chks.	
Ploughings	4		Average by Kera ...		29	29	0	per acre.
Harrowings	3		Ditto lines ...		25	24	0	" "
Sohagings	2							

Hoeings (plots 2 and 4) ... .. 5 (4 hoeings with hand hoe and one with horse hoe).

Do. (plots 1 and 3) ... ... 1 (with Khurpa).

Bar harrow twice on 8th and 9th August 1919.

Date of sowing—7th August 1919.

Date of harvesting—14th November 1919.

Statement No. 6.

OUTTURN OF SENJI (MELILOTUS PARVIFLORA) GROWN IN SQUARE 27, AREA C, DURING 1919-20.

Square and plot.	Sub-plot.	Area in kanals.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Remarks.
27 / C-1	1	4	111	21	223	2	After maize sown by "kera."
	2	4	132	28	265	16	Ditto in "lines."
	3	4	118	34	237	28	Ditto in "kera."
	4	4	93	28	187	16	Ditto in "lines."

Watered on 6th October 1919, 18th October 1919, 25th November 1919, 9th December 1919, 10th January 1920, 30th January 1920, 16th February 1920.

Harvested plot I on 23rd February 1920 to 27th February 1920.

Ditto II on 28th February 1920 to 2nd March 1920.

Ditto III on Ditto ditto.

Ditto IV on 23rd February 1920 to 27th February 1920.

Statement No. 7.

DIFFERENT METHODS OF SOWING MAIZE IN TENANTS' AREA, KHARIF 1919.

Square and plot.	No. of sub-plot.	Variety.	Treatment.	Area. Kanals.	Area. Marlas.	Date of Sowing.	Date of Harvesting.	Weight of fresh cobs. Maunds.	Weight of fresh cobs. Seers.	Weight of dry cobs. Maunds.	Weight of dry cobs. Seers.	Weight of grain. Maunds.	Weight of grain. Seers.	Yield of grain per acre. Maunds.	Yield of grain per acre. Seers.	Yield of grain per acre. Chataks.	Number of irrigations with dates.	Number of hoeings.	Remarks.
3 / 17	1	Led Local Maize.	Kera behind the country plough.	2	4	6th August 1919 ...	8th November 1919...	13	32	9	33	7	35	28	25	7	Three on— 4th September 1919. 1st October 1919. 12th October 1919.	Khurpa hoeing 1 ...	Germination good. Crop fairly good. Slightly attacked by borer.
	2		Lines 2 feet apart ...	2	4	Ditto ...	Ditto ...	15	26	9	39	8	2	29	10	14		Bullock hoeing 3 ...	Ditto.
	3		Kera behind the country plough.	2	4	Ditto ...	Ditto ...	14	21	9	20	7	28	28	0	0		Khurpa hoeing 1 ...	Ditto.
	4		Lines 2 feet apart ...	2	4	Ditto ...	Ditto ...	10	39		7	5	28	20	29	1		Bullock hoeing 3	Germination good. Crop poor owing to the land being poor this side, partly attacked by borer.
6 / 5	1		Kera behind the country plough.	1	18	7th August 1919 ...	18th November 1919	10	4	7	15	6	5	25	31	9	Three on— 4th September 1919. 28th September 1919. 11th October 1919.	Khurpa hoeing 1 ...	Germination good, slightly attacked by borer.
	2		Lines 2 feet apart ...	1	18	Ditto ...	Ditto ...	10	35	7	27	6	17	27	2	1		Bullock hoeing 3 ...	Ditto.
	3		Kera behind the country plough.	1	18	Ditto ...	Ditto ...	8	30	6	15	5	12	22	12	10		Khurpa hoeing 1 ...	Ditto.
	4		Lines 2 feet apart.	1	18	Ditto ...	Ditto ...	8	8	5	30	4	28	19	31	9		Bullock hoeing 3 ...	Germination poor. Badly attacked by borer.
6 / 6	1		Kera behind the country plough.	1	19	8th August 1919 ...	14th November 1919	5	14	4	29	4	0	16	16	6	Three on— 4th September 1919. 28th September 1919 11th October 1919.	Khurpa hoeing 1 ...	Germination poor. Attacked by borer.
	2		Lines 2 feet apart ...	1	19	Ditto ...	Ditto ...	4	26	3	15	2	27	10	38	15		Bullock hoeing 3 ...	Germination thin. Attacked by borer.
	3		Kera behind the country plough.	1	19	Ditto ...	Ditto ...	5	0	4	3	3	9	13	9	4		Khurpa hoeing 1 ...	Germination poor. Attacked by borer.
	4		Lines 2 feet apart ...	1	19	Ditto ...	Ditto ...	2	31	2	0	1	17	5	33	13		Bullock hoeing 3 ...	Germination bad. Attacked by borer.
13 / 8	1		Kera behind the country plough.	2	2	6th August 1919 ...	14th November 1919	6	31	4	18	3	24	13	28	9	Three on— 6th September 1919. 24th September 1919 6th October 1919.	Khurpa hoeing 1 ...	Germination fair. Attacked by borer.
	2		Lines 2 feet apart ...	2	2	Ditto ...	Ditto ...	6	31	4	30½	3	33½	14	24	12		Bullock hoeing 3 ...	Ditto.
	3		Kera behind the country plough.	2	2	Ditto ...	Ditto ...	6	9	3	38	3	14	12	30	7		Khurpa hoeing 1 ...	Ditto.
	4		Lines 2 feet apart ...	2	2	Ditto ...	Ditto ...	7	7	4	34½	4	0	15	9	8		Bullock hoeing 3 ...	Ditto.
19 / 10	1		Kera behind the country plough.	2	3	Ditto ...	10th November 1919	6	13	4	½	3	9½	12	1	13	Three on— 11th September 1919 26th September 1919 25th October 1919.	Khurpa hoeing 1 ...	Germination poor. Attacked by borer.
	2		Lines 2 feet apart ...	2	3	Ditto ...	Ditto ...	6	19	4	5	3	10	12	3	11		Bullock hoeing 3 ...	Ditto.
	3		Kera behind the country plough.	2	3	Ditto ...	Ditto ...	5	30	4	3½	3	8	11	36	4		Khurpa hoeing 1 ...	Ditto.
	4		Lines 2 feet apart ...	2	3	Ditto ...	Ditto ...	5	25	3	26	2	38	10	1	13		Bullock hoeing 3 ...	Germination bad. Attacked by borer.

		Area. Kanals.	Area. Marlas.	Average yield per acre. Maunds.	Average yield per acre. Seers.	Average yield per acre. Chataks.	Average yield calculated on yield per acre. Mds.	Srs.	Chts.
1	Kera behind the country plough.	20	12	47	24½	18 19 9	18	19	4
2	Lines 2 feet apart ...	20	12	42	30½	16 24 4	16	22	10

Statement No. 8.

RESULTS OF CULTURAL EXPERIMENTS WITH WHEAT GROWN IN SQUARE 27, AREA D, RABI 1919-20.

No. of square.	No. of plot.	Variety.	Treatment.	Area in acres.	Actual outturn.						Outturn per acre.						Dates of waterings.	Remarks.
					Grain.			*Bhusa.*			*Grain.*			*Bhusa.*				
					Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.		
27	D-1	Punjab XI ...	Ploughed with Raja plough 6″ deep ...	½	19	38	2	36	24	14	39	36	4	73	9	12	9th December 1919. 23rd February 1920. 30th March 1920.	Deeply stirred means running deshi muna after the Raja in the same furrow.
	D-2	Do. ...	Deeply stirred	½	19	16	6	32	39	10	38	32	12	65	39	4		
	D-3	Do. ...	Ploughed with Raja plough 6″	½	18	39	6	35	31	10	37	38	12	71	23	4		
	D-4	Do. ...	Deeply stirred	½	19	32	4	37	3	12	39	24	8	74	7	8		
	D-5	Do. ...	Raja plough 6″ deep	½	21	23	6	40	15	10	43	6	12	80	31	4		
	D-6	Do. ...	Deep ploughing 9″ deep	½	18	37	8	31	16	8	37	35	0	62	33	0		
	D-7	Do. ...	Raja plough 6″ deep	½	17	15	0	31	10	0	34	30	0	62	20	0		
	D-8	Do. ...	Deep ploughing 9″ deep	½	20	24	2	39	6	14	41	8	4	78	13	12		

Average yields per acre.

	Grain per acre. Mds.	Srs.	Chts.	*Bhusa per acre.* Mds.	Srs.	Chts.
Raja plough 6″ deep	38	37	15	72	1	1
Deeply stirred	39	8	10	70	3	6
Deeply ploughed 9″ deep with R. N. E. plough	39	21	10	70	23	6

Ploughings ... 4 Harrowings ... 11 Sohagings ... 6 Surface harrowing and weeding ... 1

Sown on 2nd November 1919 and harvested on 26th April 1920 to 28th April 1920.

Statement No. 9.

HOT WEATHER CULTIVATION *VERSUS* RAIN PLOUGH IN TENANTS' AREA DURING RABI 1919-20.

No. of square.	No. of plot.	Type of wheat.	Area.		Actual outturn of grain.			Actual outturn of Bhusa.			Outturn per acre of grain.			Outturn per acre of Bhusa.			Date of sowing.	Number of irrigations with dates.	Remarks.
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
		(a) Hot weather ploughing.																	
6	8	Type No. 11 ...	8	10	14	18	0	38	23	0	13	23	8 8/17	36	11	12 12/17	10th November 1919.	19th December 1919, 18th February 1920 and 26th March 1920.	Germination fairly good, crop fair except in kallar patches.
6	10	Ditto ...	7	5	14	12	0	27	3	0	15	31	2 22/29	29	35	80/145	7th November 1919.	Ditto	Ditto ditto.
6	12	Ditto ...	8	3	16	36	0	31	2	0	16	20	7 139/163	30	19	2 42/163	Ditto	Ditto	Ditto ditto.
6	14	Ditto ...	8	11	18	1	8	38	26	8	16	11	11 23/121	30	13	1 101/171	10th November 1919.	Ditto	Ditto ditto.
		Average yield per acre	32	9	63	27	0	135	14	0	15	27	15	33	14	12	...	...	Average yield per acre calculated on yield per acre. Maunds. 15 Seers. 21 Chataks. 12
		(b) Rain ploughing.																	
6	7	Type No. 11 ...	9	2	21	10	0	47	16	0	18	27	4 4/91	41	26	83 11/91	10th November 1919.	19th December 1919, 18th February 1920 and 26th March 1920.	Germination fairly good, crop fair except in kallar patches.
6	9	Ditto ...	8	14	15	4	0	28	26	0	13	35	6 38/87	26	13	12 60/87	7th November 1919.	Ditto	Ditto ditto.
6	11	Ditto ...	7	2	16	21	0	36	7	0	18	24	12 44/71	40	30	4 4/143	Ditto	Ditto	Ditto ditto.
6	13	Ditto ...	8	1	19	2	0	40	11	0	18	31	144/161	40	0	15 145/161	10th November 1919.	Ditto	Ditto ditto.
		Average yield per acre.	32	19	71	37	0	152	20	0	17	18	8	37	1	½	...	...	Average yield per acre calculated on yield per acre. Maunds. 17 Seers. 19 Chataks. 7

Statement No. 10.

OUTTURN OF 4-F AMERICAN COTTON GROWN IN SQUARE 26 DURING KHARIF 1919.

No. of plot.	No. of sub-plot.	Treatment.	Area in acres.	Actual outturn.			Outturn per acre.			Dates of watering.	Irrigation in inches.		Remarks.
				Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.		Before ridging.	After ridging.	
A3 1	*b*1	Drilled on flat	21/40	0	18	8	1	37	6	6th June 1919, 28th June 1919, 18th July 1919, 5th September 1919, 21st September 1919, 5th October 1919, 30th October 1919.	10·27	13·77	Cotton did fairly well till the middle of August. Afterwards it began to turn yellow and many plants died. The crop was then very poor as the yields show.
	*b*2	Drilled on flat ridged afterwards...	11/40	0	20	12	2	6	12			8·22	
A3 2	*b*1	Drilled on flat	11/40	0	22	3	2	12	12	5th May 1919, 6th June 1919, 28th June 1919, 18th July 1919, 5th September 1919, 21st September 1919, 5th October 1919, 30th October 1919.	14·61	15·76	
	*b*2	Drilled on flat ridged afterwards...	17/40	0	21	1	2	8	1			11·39	
A3 3	*b*1	Drilled on flat	1/4	0	23	12	2	15	0	6th June 1919, 28th June 1919, 18th July 1919, 8th September 1919, 21st September 1919, 5th October 1919, 30th October 1919.	10·80	14·95	
	*b*2	Drilled on flat ridged afterwards ...	1/4	0	23	1	2	12	4			11·48	

Average yield of 4-F cotton—

Drilled on flat—

Total area ($\frac{67}{92}$ acre).

	Mds.	Srs.	Chks.
Total yield	1	24	7
Yield per acre	2	8	8

Drilled on flat and ridged afterwards—

Total area = $\frac{67}{92}$ acre.

Total yield	1	24	14
Yield per acre	2	9	1

Ploughing	1
Harrowings	6
Sohagings	4

Hoeings—9 in $\frac{A3}{2}$ and 8 in $\frac{A3}{1 \text{ and } 3}$.

Ridging done thrice in portion 62

Date of sowing—8th April 1919.

Picking commenced on 27th October 1919, and finished on 13th January 1920.

Statement No. 11.

SHOWING RESULTS OF SOWING COTTONS IN LINES *VERSUS* BROADCAST WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Broadcast. Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	No. of square and plot.	No. of sub-plot.	Lines. Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Previous crop.	Remarks.
										4 F.											
d.										6											
25	2	1	5	0	7	13	1	10	0	25	4	0	19	0	8	0	1	27	6	Gram and fallow	Broadcast plot one hoeing with country plough on 19th July 1919. Line plots got 4 hoeings on 6th May 1919, 5th June 1919, 19th July 1919, 3rd August 1919. Four waterings in both on 3rd June 1919, 16th July 1919, 11th September 1919, 28th September 1919. Poor sandy soil. Stand good.
16										16											
13	2	1	19	0	29	12	3	2	1	13	4	1	18	0	28	0	2	37	14	Gram ...	Broadcast plot one hoeing with country plough on 19th July 1919. Line plot got four hoeings on 12th May 1919, 19th June 1919, 19th July 1919, 11th August 1919. Five waterings in both on 15th June 1919, 16th July 1919, 30th August 1919, 25th September 1919, 7th October 1919.
		3	4	0	37	9	2	13	14	...	...	2	17	0	36	0	2	21	1		
												Average yield per acre.									
												Mollesoni 24									
6										6											
25	1	1	18	2	31	12	11	30	8	25	3	1	18	3	15	13	14	11	13	Gram and fallow	Broadcast plot one hoeing with country plough on 19th July 1919. Line plots got four hoeings on 6th May 1919, 5th June 1919, 19th July 1919, 2nd August 1919. Four waterings in both on 3rd June 1919, 16th July 1919, 11th September 1919, 28th September 1919. Poor sandy soil. Stand good.
16										16											
13	1	1	19	2	35	6	11	33	6	13	3	1	19	3	35	0	15	35	14	Gram ...	Broadcast plot one hoeing with country plough 19th July 1919. Line plot got four hoeings on 12th May 1919, 19th June 1919, 19th July 1919, 11th August 1919. Five waterings in both on 15th June 1919, 16th July 1919, 30th August 1919, 25th September 1919, 7th October 1919. Heavy good loam. Stand good.
		3	17	5	27	2	11	31	15	...	...	3	17	7	10	13	15	3	13		
												Average yield per acre.									

Statement No. 12.

RESULTS OF RIDGING UP THE PLANTS AFTER SOWING IN LINES *VERSUS* NO RIDGING WITH MAIZE, IN TENANTS' AREA, KHARIF 1919.

Square and plot.	No. of sub plot.	Variety.	Treatment.	Area. Kanals.	Area. Marlas.	Date of Sowing.	Date of Ridging up the plants.	Date of Harvesting.	Weight of Fresh cobs. Maunds.	Weight of Fresh cobs. Seers.	Weight of Dry cobs. Maunds.	Weight of Dry cobs. Seers.	Weight of Grain. Maunds.	Weight of Grain. Seers.	Yield of Grain per acre. Maunds.	Yield of Grain per acre. Seers.	Yield of Grain per acre. Chataks.	Number of irrigations with dates.	Number of hoeings with dates.	Time taken in minutes in 2 irrigations after ridges.	Remarks.
5	1	Red local maize.	Drilled and the plants ridged up	2	3	5th August 1919	16th September 1919.	9th November 1919.	9	8	6	11	5	11	19	25	2	Three on— 11th September 1919. 26th September 1919. 8th October 1919.	Three on— 26th August 1919 29th August 1919. 16th September 1919.	50 minutes	Germination thin. Attacked by borer: crows also did some damage.
11	2		Drilled and the plants not ridged	2	3	Ditto	...	Ditto	9	11	6	14	5	12	19	28	13			58 minutes	
	3		Drilled and the plants ridged up	2	3	Ditto	16th September 1919.	Ditto	8	29	5	2	4	8	15	25	2			49 minutes	
	4		Drilled and the plants not ridged	2	3	Ditto	...	Ditto	6	30	4	25	3	35	14	16	12			57 minutes	
7	1		Drilled and the plants ridged up	1	19	7th August 1919	9th September 1919.	7th November 1919.	6	36	4	32	3	39	16	12	5	Three on— 4th September 1919. 30th September 1919. 11th October 1919.	Three on— 26th August 1919 28th August 1919 8th September 1919.	43 minutes	Germination thin. Attacked by borer. Germination thin. attacked by borer. The land also was poor here.
15	2		Drilled and the plants not ridged	1	19	Ditto	...	Ditto	8	2	5	15	4	19	18	14	5			50 minutes	
	3		Drilled and the plants ridged up	1	19	Ditto	9th September 1919.	Ditto	7	20	5	5	4	10	17	17	7			40 minutes	
	4		Drilled and the plants not ridged	1	19	Ditto	...	Ditto	6	28	4	12	3	22	14	22	13			50 minutes	
10	1		Drilled and the plants ridged up	1	17	6th August 1919	8th September 1919.	8th November 1919.	5	15	4	25	3	20	15	5	6	Three on— 3rd September 1919. 26th September 1919. 7th October 1919.	Four on— 23rd August 1919 25th August 1919 29th August 1919 8th September 1919.	39 minutes	Germination thin. Attacked by borer. Crows also did some damage.
5	2		Drilled and the plants not ridged	1	17	Ditto	...	Ditto	6	33	4	35	3	25½	15	29	3			51 minutes	
	3		Drilled and the plants ridged up	1	17	Ditto	8th September 1919.	Ditto	4	37	3	22	2	27	11	22	11			42 minutes	Germination poor. Attacked by borer.
	4		Drilled and the plants not ridged	1	17	Ditto	...	Ditto	4	31	3	1	2	8	9	20	8			50 minutes	Germination poor. Attacked by borer: crows did some damage.
16	1		Drilled and the plants ridged up	2	3	8th August 1919	11th September 1919.	8th November 1919.	10	7	8	10	6	16	23	32	9	Three on— 6th September 1919. 25th September 1919. 7th October 1919.	Five on— 24th August 1919 27th August 1919 28th August 1919 29th August 1919 10th September 1919.	51 minutes	Germination fairly good. Attacked by borer.
17	2		Drilled and the plants not ridged	2	3	Ditto	...	Ditto	10	24	8	17	6	25	24	26	1			64 minutes	
	3		Drilled and the plants ridged up	2	3	Ditto	11th September 1919.	Ditto	13	3	10	9	8	0	29	30	11			50 minutes	
	4		Drilled and the plants not ridged	2	3	Ditto	...	Ditto	11	27	9	21	7	17	27	25	2			61 minutes	
17	1		Drilled and the plants ridged up	2	0	7th August 1919	11th September 1919.	10th November 1919.	12	7	8	8	6	24	26	16	0	Three on— 12th September 1919. 25th September 1919. 5th October 1919.	Four on— 23rd August 1919 28th August 1919 1st September 1919. 10th September 1919.	120 minutes	Germination fairly good. Attacked by borer.
11	2		Drilled and the plants not ridged	2	0	Ditto	...	Ditto	11	6	7	36	6	12	25	8	0			135 minutes	
	3		Drilled and the plants ridged up	2	0	Ditto	11th September 1919.	Ditto	12	36	7	30	7	5	28	20	0			128 minutes	
	4		Drilled and the plants not ridged	2	0	Ditto	...	Ditto	17	24	10	1	8	1	32	4	0			132 minutes	
			Average yield per acre.																Average yield calculated on yield per acre.		
			Drilled and the plants ridged up	20	4	...	...	...	...	...	...	...	52	0	20	23	12		Mds. s. c. 20 16 12		
			Drilled and the plants not ridged	20	4	...	...	...	...	...	...	...	51	6½	20	10	8		20 7 9		

Statement No. 13.

SHOWING THE RESULTS OF IRRIGATION EXPERIMENTS TILL JULY WITH 4-F. COTTON GROWN IN SQUARE 10, KHARIF 1919.

No. of plot.	No. of sub-plot.	Treatment.	Area. Kanal.	Area. Marla.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Irrigation in inches for sowing (round) on 6th April 1919.	Number of irrigations. Till July.	Number of irrigations. After July.	Number of irrigations. Total.	Dates of irrigations. Till July.	Dates of irrigations. After July.	Inches of irrigations. Till July.	Inches of irrigations. After July.	Total inches of irrigations after sowing.	Total inches of irrigations including rauni.	Rainfall after sowing till last watering.	Total inches including rain.	Remarks.
C1b	1	Irrigation after every 20 days.	2	0	9	8	0	38	3·15	4	5	9	24th May 1919, 11th June 1919, 1st July 1919, 10th July 1919.	27th July 1919, 5th August 1919, 21st September 1919, 5th October 1919, 24th October.	11·70	14·48	26·18	29·33	7·98	37·31	In some plots cotton sticks were also weighed; they were twice as much in 10 days plots as in plots not watered till July. Plots watered every ten days were first to flower while plots not watered till July last of all.
	2	Irrigation after every 10 days.	2	0	13	7 1/3	1	13 14/16	3·15	8	5	13	1st May 1919, 9th May 1919, 24th May 1919, 1st June 1919, 11th June 1919, 21st June 1919, 1st July 1919, 10th July 1919.	Ditto	22·57	14·48	37·05	40·22	7·98	48·18	
	3	No irrigation till July	2	0	15	14	1	23 1/2	3·15	1	5	6	10th July 1919	Ditto	2·98	14·48	17·46	20·61	7·98	28·59	In this respect size of ball was largest in plots not watered till July.
	4	Irrigation after every 30 days.	2	0	24	4 1/2	2	17 3/16	3·15	2	5	7	11th June 1919, 10th July 1919.	Ditto	5·96	14·48	20·44	23·59	7·98	31·57	
C2b	1	Irrigation after every 10 days.	2	0	23	15 1/2	2	15 14/16	3·15	8	5	13	1st May 1919, 9th May 1919, 24th May 1919, 1st June 1919, 11th June 1919, 21st June 1919, 1st July 1919, 10th July 1919.	Ditto	22·80	14·69	37·49	40·64	7·98	48·62	
	2	Irrigation after every 20 days.	2	0	14	8	1	18	3·15	4	5	9	24th May 1919, 11th June 1919, 1st July 1919, 10th July 1919.	Ditto	11·70	14·69	26·39	29·54	7·98	37·52	
	3	Irrigation after every 30 days.	2	0	17	14	1	31 1/2	3·15	2	5	7	11th June 1919, 10th July 1919.	Ditto	5·96	14·69	20·65	23·80	7·98	31·78	
	4	No water till July. Including poor area.	2	0	16	7	1	25 4/4	3·15	1	5	6	10th July 1919.	Ditto	2·98	14·69	17·67	20·82	7·98	28·80	
		No water till July. Excluding poor area	1	10·4	13	4	1	29 3/4													

AVERAGE OUTTURNS PER ACRE.

Irrigation after every 10 days.	*Irrigation after 20 days.*	*Irrigation after 30 days.*	*No water till July without poor area.*	*No water till July with poor area.*
Maunds. Seers. Chataks.	Maund. Seers Chataks	Maunds. Seers. Chataks	Maund. Seers. Chataks.	Maund. Seers. Chataks.
1 34 14	1 8 0	2 4 5	1 26 10	1 24 10

Cultivation.

Ploughings—Raja ... 1

Levelling with sohaga for 3 days—

Harrowings: With horse hoe ... 3; With sp. toothed harrow ... 1; With Bar harrow ... 2

Sahagings ... 2

Hoeings: Horse hoe ... 8 to plots $\frac{C^1b}{2}$, & $\frac{C^2b}{1}$, 6 to plots $\frac{C^2b}{2}$ & $\frac{C^1b}{1}$, 4 to plots $\frac{C^2b}{3}$ & $\frac{C^1b}{4}$ & 3 to plots $\frac{C^2b}{4}$ & $\frac{C^1b}{3}$

Drill harrow ... 4 to ditto. 3 to ditto, 2 to ditto & 1 to ditto.

Date of sowing—10th April 1919.

Picking began on 25th November 1919.

Picking finished on 5th December 1919.

Statement No. 14.

SHOWING THE RESULTS OF IRRIGATION EXPERIMENT ON WARD FROM FLOWERING PERIOD WITH 4-F. COTTON GROWN IN SQUARE 10, KHARIF 1919.

No. of plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Irrigation in inches for sowing (rauni) on 6th April 1919.	Number of irrigations. Till flowering time.	Number of irrigations. After flowering time.	Number of irrigations. Total.	Dates of irrigations. Till flowering time.	Dates of irrigations. After flowering time.	Inches of irrigations after sowing. Till flowering time.	Inches of irrigations after sowing. After flowering time.	Inches of irrigations after sowing. Total.	Total inches of irrigations including rauni.	Rainfall after sowing till last watering.	Total inches including rain.	Remarks.
B_1b	1	Irrigation after every 3 weeks.	2	0	13	0	1	12	3·15	3	3	6		19th September 1919, 10th October 1919, 24th October 1919.	8·93	7·32	16·25	19·40	7·98	27·38	
	¼	Ditto	1	0	5	0	1	0	3·15	3	3	6		Ditto	8·93	7·32	16·25	19·40	7·98	27·38	
	¾	Ditto	1	0	8	10	1	29	3·15	3	3	6		Ditto	8·93	7·32	16·25	19·40	7·98	27·38	
	½	Irrigation after every week	1	0	8	5	1	26½	3·15	3	9	12		13th August 1919, 5th September 1919, 12th September 1919, 19th September 1919, 26th September 1919, 3rd October 1919, 10th October 1919, 17th October 1919, 24th October 1919.	8·93	21·51	30·44	33·59	7·98	41·57	
	4	Ditto	2	0	12	3	1	8¼	3·15	3	9	12		Ditto	8·93	21·51	30·44	33·59	7·98	41·57	
	Kutor	Irrigation after every 3 weeks.	1	1/16	7	2	1	16 1/16	3·15	3	4	7	17th June 1919, 10th July 1919, 27th July 1919.	12th September 1919, 26th September 1919, 10th October 1919, 24th October 1919.	8·93	10·35	...	...	7·98	...	
B_2b	1	Irrigation after every 4 weeks.	2	0	10	13	1	8	3·15	3	2	5		26th September 1919, 24th October 1919.	8·93	5·55	14·48	17·63	7·98	25·61	
	2	Ditto	2	0	7	1	0	28¼	3·15	3	2	5		Ditto	8·93	5·55	14·48	17·63	7·98	25·61	
	3	Irrigation after every 2 weeks.	2	0	9	14	0	39½	3·15	3	4	7		12th September 1919, 26th September 1919, 10th October 1919, 24th October 1919.	8·93	10·35	19·28	22·43	7·98	30·41	
	Kutor	Irrigation after every week	1	1/16	5	11	1	5 5/16	3·15	3	9	12		13th August 1919, 5th September 1919, 12th September 1919, 19th September 1919, 26th September 1919, 3rd October 1919, 17th October 1919, 24th October 1919.	8·93	21·51	...	...	7·98	...	

Average outturns per acre.

Irrigation every week. Mds. Srs. Chtks.	*Irrigation every two weeks.* Mds. Srs. Chtks.	*Irrigation every three weeks.* Mds. Srs. Chtks.	*Irrigation every four weeks.* Mds. Srs. Chtks.
1 13 9	1 8 0	1 13 10	0 35 10

Cultivation.	
Ploughing—Raja	1
Sohagings	2
Harrowings—Horse hoes ...	3
Harrowings—Harrow	1
Harrowings—Bar harrow	1 in sub-plot 4 of B 2b and sub-plots 2, 3 and 4 of B 2b and drill harrow in remaining ones.
Levelling with Sohaga for 3 days.	
Hoeings—Horse hoes	5
Hoeings—Drill harrow	2

Date of sowing—10th April 1919.
Picking began on 25th November 1919.
Picking finished on 5th December 1919.

Statement No. 15.

SHOWING THE RESULTS OF WATERING EXPERIMENTS WITH 4-F. COTTON GROWN IN SQUARE 32 DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Treatment.	Area.		Actual outturn.			Outturn per acre.			Number of waterings with dates till July.	Number of waterings with dates after July.	Remarks.
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
32—3 D	1	Watering after every 30 days till July ...	2	0	0	30	0	3	0	0	One watering on— 10th June 1919.		
	2	No watering till July	2	0	0	15	0	1	20	0	*Nil.*		
	3	Watering after every 10 days till July ...	2	0	0	17	7	1	29	12	Six waterings on— 11th May 1919. 21st May 1919. 31st May 1919. 10th June 1919. 20th June 1919. 1st July 1919.	Seven waterings on— 11th July 1919. 27th July 1919. 16th August 1919. 10th September 1919. 24th September 1919. 7th October 1919. 30th October 1919.	
	4	Watering after every 20 days till July ...	2	0	0	15	11	1	22	12	Three waterings on— 21st May 1919. 10th June 1919. 1st July 1919.		
32—4 D	1	Watering after every 20 days till July ...	2	0	0	12	12	1	11	0	Three waterings on— 21st May 1919. 10th June 1919. 1th July 1919.		
	2	Watering after every 10 days till July ...	2	0	0	13	2	1	12	8	Six waterings on— 11th May 1919. 21st May 1919. 31st May 1919. 10th June 1919. 20th June 1919. 1st July 1919.	Seven waterings on— 11th July 1919. 27th July 1919. 16th August 1919. 9th September 1919. 23rd September 1919. 7th October 1919. 30th October 1919.	
	3	No watering till July	2	0	0	2	14	0	11	8	*Nil*		
	4	Watering after every 30 days till July ...	2	0	0	5	15½	0	28	14	One watering on— 10th June 1919.		
32—5 D	1	Watering after every 10 days till July ...	2	0	0	14	4	1	17	0	Six waterings on— 11th May 1919. 21st May 1919. 31st May 1919. 10th June 1919. 20th June 1919. 1st July 1919.		
	2	Watering after every 20 days till July ...	2	0	0	11	11	1	6	12	Three waterings on— 21st May 1919. 10th June 1919. 1st July 1919.		
	3	Watering after every 30 days till July ...	2	0	0	4	15	0	19	12	One watering on— 10th June 1919.		
	4	No watering till July	2	0	0	1	1½	0	4	6	*Nil.*		
	1	Watering after every 10 days till July ...	6	0	1	4	13	1	19	12			
	2	Watering after every 20 days till July ...	6	0	1	0	2	1	13	8			
	3	Watering after every 30 days till July ...	6	0	1	0	14½	1	14	9			
	4	No watering till July	6	0	0	18	15½	0	25	5			

Ploughing 1
Harrowings 4
Sohagings 2
Hoeings :—3 to all the plots and
8 to plots watered after every 10 days till July.
6 to watered after every 20 days till July.
4 to watered after every 30 days till July.
3 to no watering till July.
Picking began on the 29th of October 1919 and finished on 17th January 1920.

Statement No 16.

SHOWING THE RESULTS OF WATERING EXPERIMENTS WITH 4-F COTTON GROWN IN SQUARE 32 DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Number of waterings with dates till July.	Number of waterings with dates after July.	Remarks.
32 —1 D	1	Waterings after every 4 weeks after July ...	2	0	0	7 31—16	3	12 5—16	Three on— 17th June 1919, 11th July 1919, and 27th July 1919.	Two on— 23rd September 1919. 20th October 1919. Three on— 16th September 1919. 7th October 1919. 25th October 1919. Four on— 10th September 1919. 23rd September 1919. 7th October 1919. 20th October 1919. Eight on— 14th August 1919. 3rd September 1919. 16th September 1919. 23rd September 1919. 30th September 1919. 7th October 1919. 13th October 1919. 20th October 1919.	
	2	Do. do 3 weeks	2	0	1	11 10—16	5	12 2—16			
	3	Do. do. 2 weeks	2	0	1	8 6—16	4	26			
	4	Do. do. 1 week	2	0	1	6 —16	4	8 1—16			
32 —2 D	1	Do. do. 1 week	2	0	0	4 27—16	2	28		Ditto.	
	2	Do. do. 2 weeks	2	0	0	9 24—16	2	4 18—16		32 As in—1 sub-plot 3. D	
	3	Do. do. 3 weeks	2	0	0	12 25—16	2	23		Ditto 2.	
	4	Do. do. 4 weeks	2	0	0	7 20—16	2	12 1—16		Ditto 1.	
		Do. do. 1 week	4	0	1	10 27—16	3	4 15—16			
		Do. do. 2 weeks	4	0	1	1 31—16	3	2 22—16			
		Do. do. 3 weeks	4	0	1	7 26—16	3	14 32—16			
		Do. do. 4 weeks	4	0	1	14 11—16	2	12 23—16			

Cultivation.

Ploughing 1
Harrowings 4
Sohagings 2
Hoeings ... ... 6 to all the plots.

Pickings began on 29th October 1919,
Finished on 17th January 1920.

Statement No. 17.

SHOWING THE RESULTS OF 4-F WITH ORDINARY WATERINGS UP TO JULY *VERSUS* NO WATERINGS TILL JULY AND AFTERWARDS WITH EQUAL NUMBER OF WATERINGS GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Irrigations with dates.	Previous crop.	Remarks.
6	1	4-F. watered ordinarily in June ...	1	6		0	15	15	2	18	1	Seven on— 8th April 1919. 6th May 1919. 9th May 1919. 12th June 1919. 22nd June 1919. 10th July 1919. 3rd August 1919.	Five on— 8th June 1919. 20th June 1919. 8th July 1919. 13th September 1919. 1st October 1919.	Senji	Germination regular. Stand fair.
17	3	Ditto	1	6		0	11	9	1	31	2				
	2	4-F. not watered till July	1	6		0	13	2½	2	0	15	Five on— 8th April 1919. 6th May 1919. 9th May 1919. 10th July 1919. 3rd August 1919.	Three on— 8th July 1919. 13th September 1919. 1st October 1919.	Senji	Ditto. Ditto.
	4	Ditto	1	6		0	13	2	2	0	12				
	1	4-F. watered ordinarily in June ...	1	18	Calcarious loam.	0	38	3	4	0	13	Seven on— 8th April 1919. 30th April 1919. 7th May 1919. 9th May 1919. 10th May 1919. 2nd July 1919. 10th July 1919.	Seven on— 7th June 1919. 27th June 1919. 7th July 1919. 8th September 1919. 26th September 1919. 13th October 1919. 28th October 1919.	Senji	Ditto. Germinatoin fairly good. Stand good.
10															
4	3	Ditto	1	18		0	37	13	3	39	3				
	2	4-F. not watered till July	1	18		0	32	12	3	27	14	Five on— 8th April 1919. 30th April 1919. 7th May 1919. 9th May 1919. 10th July 1919.	Five on— 7th July 1919. 8th September 1919. 26th September 1919. 13th October 1919. 28th October 1919.	Senji	Ditto. Germination fairly good. Stand irregular.
	4	Ditto	1	18		0	38	7	4	1	13				
	1	4-F. watered ordinarily in June ...	2	4		1	5	8	4	5	7	Eight on— 10th May 1919. 25th May 1919. 19th June 1919. 21st June 1919. 6th July 1919. 1st August 1919. 7th August 1919. 14th August 1919.	Five on— 16th June 1919. 1st July 1919. 10th August 1919. 26th September 1919. 12th October 1919.	Wheat	Germination fairly good. Stand good. Germination fair. Stand fair : low lying plot.
5															
19	3	Ditto	2	4	Medium loam.	0	33	9	3	2	1				
	2	4-F. not watered till July	2	4		0	29	11	3	27	15	Six on— 10th May 1919. 25th May 1919. 6th July 1919. 1st August 1919. 7th August 1919. 14th August 1919.	Four on— 1st July 1919. 10th August 1919. 26th September 1919. 12th October 1919.	Wheat	Germination fair. Stand fair. Stand poor.
	4	Ditto	2	4		0	14	14	1	14	1				
	1	4-F. watered ordinarily in June ...	1	19		1	14	10	5	24	1	Six on— 6th May 1919. 13th May 1919. 17th June 1919. 7th July 1919. 7th July 1919. 12th August 1919.	Six on— 15th June 1919. 3rd July 1919. 17th August 1919. 6th September 1919. 25th September 1919. 13th October 1919.	Wheat	Stand very poor. Highland. Germication good. Stand good. Half low lying plot.
13															
15	3	Ditto	1	19	Heaving loam.	1	9	6	5	2	9				
	2	4-F. not watered till July	1	19		1	5	1	4	24	14	Five on— 3rd July 1919. 17th August 1919. 6th September 1919. 25th September 1919. 13th October 1919.			Stand good. Stand poor to fair.
	4	Ditto	1	19		1	10	2	5	5	9	Sex on as above.		Wheat	Stand good.

Average yield per acre.

Average yield per acre calculated on yield per acre.

												Mds.	Srs.	Chtks.
	1	4-F. watered ordinarily in June and July	14	14		7	6	9	3	35	15	3	30	7
	2	4-F. not watered till July	14	14		5	37	8½	3	9	1	3	6	12

Statement No. 18.

SHOWING THE RESULTS OF 285-F WITH ORDINARY WATERINGS UP TILL JULY *VERSUS* NO WATERING TILL JULY AND AFTERWARDS WITH EQUAL NUMBER OF WATERINGS, GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual Outturn. Maunds.	Actual Outturn. Seers.	Actual Outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Irrigation with dates.	Previous crop.	Remarks.
6/16	1	285-F not water.d till July ...	1	18	Medium loam ...	1	0	9	4	10	12	Four on— 3rd June 1919. 19th July 1919. 3rd August 1919. 9th August 1919.	Four on— 16th July 1919. 4th September 1919. 28th September 1919. 11th October 1919.	Wheat ...	Germination good. Stand good.
	3	Ditto ...	1	18	Do. ...	1	1	8	4	14	12			Do. ...	Ditto.
	2	285-F watered ordinarily in June	1	17½	Do. ...	1	0	11	4	13	10	Five on— 3rd June 1919. 25th June 1919. 19th July 1919. 3rd August 1919. 9th August 1919.	Five on— 22nd June 1919. 16th July 1919. 4th September 1919. 28th September 1919. 11th October 1919.	Do. ...	Ditto.
	4	Ditto	1	16	Do. ...	0	36	9	4	2	8			Do. ...	Ditto.
5/22	1	285-F not watered till July ...	2	1	Do. ...	2	10	10	8	33	10	Six on— 5th May 1919. 5th June 1919. 6th July 1919. 1st August 1919. 6th August 1919. 14th August 1919.	Four on— 1st July 1919. 10th August 1919. 31st August 1919. 11th October 1919.	Gram ...	Ditto.
	3	Ditto	1	4	Do. ...	0	32	0	5	13	5			Do. ...	Germination good. Did not bear well. Land also poor.
	2	285-F watered ordinarily in June	2	1	Do. ...	2	5	4	8	12	11	Eight on— 25th May 1919. 5th June 1919. 19th June 1919. 21st June 1919. 6th July 1919. 1st August 1919. 6th August 1919. 14th August 1919.	Six on— 3rd June 1919. 16th June 1919. 1st July 1919. 10th August 1919. 31st August 1919. 11th October 1919.	Do. ...	Germination good. Stand good.
	4	Ditto	1	4	Do. ...	0	23	5	3	36	1			Do. ...	Germination good. Did not bear well. Land also poor here even than No.3.

	Average yield per acre.			Average yield per acre calculated on yield per acre. Mds.	Srs.	Chs.
285-F not watered till July ...	7	1	5 4 11	5	32	4
285-F watered ordinarily in June and July.	6	18½	4 23 13	5	12	4

Statement No. 19.

RESULTS OF HYRDAULIC EXPERIMENTS WITH WHEAT (TYPE II) GROWN IN SQUARE 10, RABI 1919-20 (EARLY SOWN TWO *VERSUS* THREE IRRIGATIONS).

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Grain. Maunds.	Actual outturn. Grain. Seers.	Actual outturn. Straw. Maunds.	Actual outturn. Straw. Seers.	Outturn per acre. Grain. Maunds.	Outturn per acre. Grain. Seers.	Outturn per acre. Straw. Maunds.	Outturn per acre. Straw. Seers.	Irrigation in inches with dates. For Raunion 17th October 1919.	After sowing 1st 2nd December 1919.	After sowing 2nd 22nd February 1920.	After sowing 3rd 16th March 1920.	After sowing Total inches	Total irrigation in inches including rauni.	Rainfall after sowing till ripening.	Total irrigation in inches including rainfall.	Remarks.
		EARLY SOWN.																			
10 B 1 a	1	Three irrigations	2	0	8	15	13	25	33	20	54	20	3·17	2·57	2·98	2·18	7·73	10·90	1·91	12·81	In previous year difference was made in the dates of first irrigation.
	2	Two irrigations	2	0	6	38	12	29	27	32	50	36	3·17	2·57	2·98	...	5·55	8·72	1·91	10·63	This year the difference was made in the dates of last irrigation.
	3	Three irrigations	2	0	8	36¼	14	16	35	25	57	24	3·17	2·57	2·98	2·18	7·73	10·90	1·91	12·81	
	4	Two irrigations	2	0	8	29½	18	11	34	33	73	4	3·17	2·57	2·98	...	5·55	8·72	1·91	10·63	
10 B 2 a	1	Two irrigations	2	0	7	33½	14	16	31	14	57	24	2·98	2·57	2·98	...	5·55	8·53	1·91	10·44	
	2	Three irrigations	2	0	7	10	13	6	29	0	52	24	2·98	2·57	2·98	2·18	7·73	10·71	1·91	12·62	
	3	Two irrigations	2	0	6	32½	11	18	27	10	45	32	2·98	2·57	2·98	...	5·55	8·53	1·91	10·44	
	4	Three irrigations	2	0	6	38½	12	33	27	33	51	12	2·98	2·57	2·98	2·18	7·73	10·71	1·91	12·62	

Cultivation.

Ploughings { Raja 1
Country 3
Harrowings { Horse hoes 6
Harrow 1
Bar harrows ... ... 5 to B 1 a and 6 to B 2 a
Sohagings 5

Date of sowing—31st October 1919.
Date of harvesting—23rd April 1920.

Average yield per acre

	Mds.	Srs.	Chtks.
Three irrigations	31	19	8
Two irrigations	30	13	8

Statement No. 20.

RESULTS OF HYDRAULIC EXPERIMENTS WITH WHEAT (TYPE II) GROWN IN SQUARE 10, RABI 1919-20, LATE SOWN TWO *VERSUS* THREE IRRIGATIONS.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanal.	Area. Marlas.	Actual outturn. Grain. Maunds.	Actual outturn. Grain. Seers.	Actual outturn. Straw. Maunds.	Actual outturn. Straw. Seers.	Outturn per acre. Grain. Maunds.	Outturn per acre. Grain. Seers.	Outturn per acre. Straw. Maunds.	Outturn per acre. Straw. Seers.	Irrigation in inches with dates. For rauni. 24th November 1919.	Irrigation in inches with dates. After sowing. 1st. 4th February 1920 22nd February 1920.	2nd. 5th March 1920. 16th March 1920.	3rd. 1st April 1920.	Total.	Total including rauni.	Rainfall after sowing till ripening.	Total including rain	Remarks.
		Late sown.																			
10 $\frac{C_1 a}{}$	1	Three irrigations	2	0	7	30½	10	22	31	3	42	8	3·17	2·78	2·78	2·18	7·74	10·91	1·91	12·81	In previous year difference was made in the early stages.
	2	Two irrigations	2	0	5	7½	6	34	20	30	27	16	3·17	2·98	2 38	...	5·36	8·53	1·91	10·44	This year difference was made in the last irrigation.
	3	Three irrigations	2	0	6	3¼	7	34	24	13	31	16	3·17	2·78	2·78	2·18	7.74	10·91	1·91	12·81	
	4	Two irrigations	2	0	5	16½	7	38	21	27	31	32	3·17	2·98	2·38	...	5·36	8·53	1·91	10·44	
10 $\frac{C_2 a}{}$	1	Two irrigations	2	0	6	36½	9	14	27	26	37	16	2·57	2·98	2·38	....	5·36	7·93	1·91	9 84	
	2	Three irrigations	2	0	7	4¾	9	27	28	19	38	28	2·57	2·78	2·78	2·18	7·74	10·31	1·91	12·22	
	3	Two irrigations	2	0	5	19½	8	30	21	37	35	0	2·57	2·98	2·38	...	5·36	7·93	1·91	9 84	
	4	Three irrigations	2	0	4	31½	7	12	19	7	29	8	2·57	2·78	2·78	2·18	7·74	10·31	1·91	12·22	

Cultivation.

Ploughings { Raja plough 1
Country ploughs 2

Harrowings { Horse hoes 6
Harrow 1
Bar harrows ... ... 4 to sub-plots 2 and 4 and 5 to sub-plots 1 and 3 of each plot.

Sohagings 3

Date of sowing—7th December 1919.
Date of harvesting—30th April 1920.

Average yields per acre.

	Mds.	Srs.	Chataks.
Three irrigations	25	30	8
Two irrigations	23	0	0

Statement No. 21.

RESULTS OF HYDRAULIC EXPERIMENTS WITH TORIA GROWN IN SQUARE 10, DURING 1919-20 (EARLY SOWN—ONE *VERSUS* TWO IRRIGATIONS).

No. of plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Grain. Maunds.	Actual outturn. Grain. Seers.	Actual outturn. Straw. Maunds.	Actual outturn. Straw. Seers.	Outturn per acre. Grain. Maunds.	Outturn per acre. Grain. Seers.	Outturn per acre. Straw. Maunds.	Outturn per acre. Straw. Seers.	Irrigations in inches for (sowing) rauni dated 27th August 1919.	Irrigations in inches after sowing. Dated 17th October 1919	Irrigations in inches after sowing. Dated 24th November 1919.	Irrigations in inches after sowing. Total inches.	Total including rauni.	Rainfall during growth.	Remarks.
A_1a	¼	Two irrigations	1	0	1	26¼	5	25	13	10	45	0	2·98	3·17	2·31	5·48	8·46		
	½	One irrigation	1	0	1	24	3	12	12	32	26	16	2·98	3·17	*Nil.*	3·17	6·15		
	⅝	Two irrigations	1	0	1	32¼	4	11	14	18	34	8	2·98	3·17	2·31	5·48	8·46		
	⅝	One irrigation	1	0	2	0	4	18	16	0	35	24	2·98	3·17	*Nil.*	3·17	6·15		
	¾	Two irrigations	1	0	2	2	4	11	16	16	34	8	2·98	3·17	2·31	5·48	8·46		
	¾	One irrigation	1	0	1	32½	3	38	14	20	31	24	2·98	3·17	*Nil.*	3·17	6·15		
	⅞	Two irrigations	1	0	2	2½	3	36	16	20	31	8	2·98	3·17	2·31	5·48	8·46		
	⅞	One irrigation	1	0	2	10½	4	9	18	4	33	32	2·98	3·17	*Nil.*	3·17	6·15		
	1	Two irrigations including kallar patch	1	0	1	5	2	21	9	0	20	8	2·98	3·17	2·31	5·48	8·46		Land in some plots is poor on account of having "kallar" patches. Hence yield is shown in two headings in such cases. In one case it is calculated on the whole area while in the other it is calculated on the area including "kallar" patches. In previous years difference was made in the first year while this year it was made in the last year.
		Two irrigations excluding kallar ...	0	18⅝	1	3½	2	15½	9	18¾	20	30							
	1	One irrigation including kallar ...	1	0	1	2	2	10	8	16	18	0	2·98	3·17	*Nil.*	3·17	6·15	*Nil.*	
		One irrigation excluding kallar ...	0	16 4/11	0	39½	2	2½	9	26¼	20	6⅜							
	⅛	Two irrigations including kallar ...	1	0	1	29⅜	2	32	13	38	22	16	2·98	3·17	2·31	5·48	8·46		
		Two irrigations excluding kallar ...	0	15⅜	1	27½	1	21½	17	5½	15	25							
A_1b	⅛	One irrigation including kallar ...	1	0	1	½	2	13	8	4	18	20	2·98	3·17	*Nil.*	3·17	6·15		
		One irrigation excluding kallar ...	0	14¾	0	39½	2	9½	10	28½	24	11							
	¼	Two irrigations	1	0	1	9	2	7	9	32	17	16	2·98	3·17	2·31	5·48	8·46		
	¼	One irrigation including kallar ...	1	0	1	4½	2	33	8	36	22	24	2·98	3·17	*Nil.*	3·17	6·15		
		One irrigation excluding kallar ...	0	13⅔	1	3	2	27	9	8½	22	37¼							
	⅜	Two irrigations	1	0	1	18¼	3	12	11	26	26	16	2·98	3·17	2·31	5·48	8·46		
	⅜	One irrigation	1	0	1	23	3	2	12	24	24	16	2·98	3·17	*Nil.*	3·17	6·15		

Cultivation.

Ploughings—Raja plough 1, Country plough ... 2
Sohaging 1
Harrowings 2
Horse hoeings 4
Bar harrowing 1
Date of sowing—30th August 1919 to 2nd September 1919.
Date of harvesting—17th January 1920.

Average outturn per acre.

	Including poor area. Mds. s. c.	Excluding poor area. Mds. s. c.
Two irrigations	13 5 0	13 21 ½
One irrigation	12 17 0	13 5 9

Statement No. 22.

STATEMENT SHOWING THE OUTTURN OF TORIA GROWN IN SQUARE 26.

Square and plot.	Sub-plot.	Variety.	Area in acres.	Treatment.	Date of sowing.	Date of harvesting.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Dates of waterings.	Remarks.
26 — 1 — A4	a_1	Early variety of Toria.	$\frac{1}{8}$th of an acre.	No Bar harrowing immediately after sowing.	23rd August 1919.	5th January 1920,	1	$24\frac{8}{16}$	12	36	10th October 1919. 4th November 1919. 1st December 1919.	
				Bar harrow after sowing ...			1	$21\frac{2}{16}$	8	22		
	b_1			No Bar harrowing after sowing...			1	$22\frac{8}{16}$	12	20		
				Bar harrow after sowing ...			1	1	8	8		
	a_2	Late variety of Toria.		No Bar harrow after sowing ...		27th January 1920.	1	$7\frac{14}{16}$	9	23		
				Bar harrow after sowing ...			1	8	9	24		
	b_2			No Bar harrow after sowing ...			1	$6\frac{12}{16}$	9	14		
				Bar harrow after sowing ...			1	$8\frac{8}{16}$	9	28		
26 — 2 — A4	a_1	Early variety of Toria.		No Bar harrow after sowing ...	3rd September 1919.	17th January 1920.	1	2	8	16	19th October 1919. 25th November 1919. 21st December 1919.	
				Bar harrow after sowing ...			0	$36\frac{14}{16}$	7	15		
	b_1			No Bar harrow after sowing ...			1	$16\frac{8}{16}$	11	12		
				Bar harrow after sowing ...			1	20	12	0		
	a_2	Late variety of Toria.		No Bar harrow after sowing ...		29th January 1920.	0	$37\frac{8}{16}$	7	20		
				Bar harrow after sowing ...			0	38	7	24		
	b_2			No Bar harrow after sowing ...			1	$9\frac{8}{16}$	9	36		
				Bar harrow after sowing ...			1	$\frac{14}{16}$	9	14		
26 — 3 — A4	a_1	Early variety of Toria.		No Bar harrow after sowing ...	20th September 1919.	1st and 2nd February 1920.	1	$1\frac{14}{16}$	8	15	4th November 1919. 1st December 1919.	
				Bar harrow after sowing ...			0	$38\frac{4}{16}$	7	26		
	b_1			No Bar harrow after sowing ...			1	$20\frac{14}{16}$	12	7		
				Bar harrow after sowing ...			1	$17\frac{14}{16}$	11	22		
	a_2	Late variety of Toria.		No Bar harrow after sowing ...		15th February 1920.	0	$36\frac{4}{16}$	7	10		
				Bar harrow after sowing ...			0	$33\frac{8}{16}$	6	28		
	b_2			No Bar harrow after sowing ...			1	$10\frac{12}{16}$	10	5		
				Bar harrow after sowing ...			1	$3\frac{4}{16}$	8	26		

Ploughings ... 3

Harrowings ... 7 in plots 2 and 3 while 5 in plot 1.

Sohaging ... 1

AVERAGE OUTTURNS PER ACRE.

Variety.	No harrow. Mds.	No harrow. Srs.	No harrow. Chks.	Harrow. Mds.	Harrow. Srs.	Harrow. Chks.
Early	10	37	8	9	8	14
Late	8	38	0	8	24	0

Statement No. 23.

STATEMENT SHOWING THE OUTTURN OF TORIA GROWN IN SQUARE 27.

No. of square and plot.	Sub-plot.	Variety.	Area in acres.	Date of sowing.	Date of harvesting.	Actual yield. Maunds.	Actual yield. Seers.	Yield per acre. Maunds.	Yield per acre. Seers.	Dates of watering.	Remarks.
27 — E	3	Early ...	1	23rd August 1919 ...	5th January 1920 ...	1	5	18	0	10th October 1919. 4th November 1919. 1st December 1919.	
	4	Late ...		Ditto ...	17th January 1920 ...	1	5	18	0		Lodged on 25th November 1919, but late lodged comparatively more than early.
	5	Early ...		3rd September 1919	Ditto ...	1	9	19	24		
	6	Late ...		Ditto	31st January 1920 ...	1	8	19	8	19th October 1919. 25th November 1919. 21st December 1919.	
	7	Early ...	1	Ditto	15th January 1920 ...	1	$9\frac{1}{2}$	19	32		
	8	Late ...		Ditto	31st January 1920 ...	0	$39\frac{1}{2}$	15	32		
	9	Early ...		21st September 1919	7th February 1920 ...	0	$37\frac{1}{2}$	14	8	4th November 1919. 1st December 1919.	Lodged on 1st December 1919, late lodged more.
	10	Late ...		Ditto	15th February 1920...	0	33	13	8		
	11	Early ...		Ditto	7th February 1920 ...	0	30	12	0		
	12	Late ...		Ditto	15th February 1920...	0	$27\frac{1}{2}$	11	0		

AVERAGE OUTTURN PER ACRE.

	Mds.	s.	g.
Early variety of Toria	16	23	13
Late variety of Toria	15	17	9

Ploughings 2

Harrowings 4

Sohaging 1

Statement No. 24

SHOWING THE RESULTS OF TORIA VARIETIES GROWN IN SQUARE 43 DURING 1919-20.

No. of square and plot.	No. of sub-plot.	Variety.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
43—1 A	a	Early	No harrowing after sowing	2	0	3	38	6	15	33	8	Germination good, crop uniform.
			Harrowing after sowing...	2	0	3	22	14	14	11	8	
	b	Late	No harrowing after sowing	2	0	3	36	12	15	27	0	
			Harrowing after sowing...	2	0	4	6	14	16	17	8	
43—2 A	a	Local	No harrowing after sowing	2	0	4	5	4	16	21	0	
			Harrowing after sowing...	2	0	4	3	12	16	15	0	
	b	Early	No harrowing after sowing	2	0	3	36	14	15	27	8	
			Harrowing after sowing...	2	0	4	7	6	16	29	8	
43—3 A	a	Late	No harrowing after sowing	2	0	3	39	8	15	38	0	
			Harrowing after sowing...	2	0	4	6	0	16	24	0	
	b	Local	No harrowing after sowing	2	0	4	9	14	16	39	8	
			Harrowing after sowing...	2	0	4	6	4	16	25	0	
43—4 A	a	Early	No harrowing after sowing	2	0	4	1	6	16	5	8	
			Harrowing after sowing...	2	0	3	26	0	14	24	0	
	b	Late	No harrowing after sowing	2	0	3	36	0	15	24	0	Germination good, crop fairly uniform.
			Harrowing after sowing...	2	0	4	4	4	16	17	0	Germination good, crop uniform.
43—5 A	a	Local	No harrowing after sowing	2	0	3	32	0	15	8	0	Germination very fair, crop patchy.
			Harrowing after sowing...	2	0	3	12	0	13	8	0	Germination very fair, crop uniform.
	b	Early	No harrowing after sowing	2	0	3	10	8	13	2	0	Germination very fair, crop patchy.
			Harrowing after sowing...	2	0	3	15	0	13	20	0	Germination very fair, crop uniform.
43—6 A	a	Late	No harrowing after sowing	2	0	3	6	12	12	27	0	Germination very fair, crop patchy.
			Harrowing after sowing ...	2	0	3	7	8	12	30	0	Germination good, crop uniform.
	b	Local	No harrowing after sowing	2	0	3	11	0	13	4	0	Germination patchy.
			Harrowing after sowing ..	2	0	4	8	8	16	34	0	Germination good, crop uniform.
43—7 A	a	Early	No harrowing after sowing	2	0	3	5	0	12	20	0	
			Harrowing after sowing ..	2	0	3	4	8	12	18	0	
	b	Late	No harrowing after sowing	2	0	3	39	8	11	38	0	
			Harrowing after sowing ..	2	0	3	0	12	12	3	0	
43—8 A	a	Local	No harrowing after sowing	2	0	2	36	0	11	24	0	
			Harrowing after sowing...	2	0	2	38	0	11	32	0	Germination good and crop uniform in the harrowed portions and patchy in the unharrowed portions.
	b	Early	No harrowing after sowing	2	0	3	9	0	12	36	0	
			Harrowing after sowing ..	2	0	3	28	8	14	34	0	
43—9 A	a	Late	No harrowing after sowing	2	0	3	6	0	12	24	0	
			Harrowing after sowing ..	2	0	3	4	12	12	19	0	
	b	Local	No harrowing after sowing	2	0	2	34	12	11	19	0	
			Harrowing after sowing...	2	0	3	13	8	13	14	0	

Average outturn per acre.

	No harrow. Mds.	Srs.	Chks.	*Harrow.* Mds.	Srs.	Chks.
Early ...	14	13	4	14	15	5⅓
Late ...	13	28	6	14	2	11
Local ...	13	23	3⅕	14	12	9⅗

Date of sowing 43—A, 7, 8 and 9 sown on 7th September 1919.
43—A 5 and 6 sown on 9th September 1919.
43—A, 3 and 4 sown on 10th September 1919.
43—A, 1 and 2 sown on 11th September 1919.

Ploughing with Raja plough ... 1
Ditto Desi plough ... 2
Harrowings ... 7

Waterings with dates, plot Nos. 43—A, 18th October 1919, 7, 8, 9. 43—A 24th October 1919, 1, 2, 3, 4, 5, 6. — 1st watering.
43—A 10th-11th November 1919. 1 to 9. — 2nd watering.
43—A 7th-8th December 1919. 1 to 9. — 3.d watering.

Statement No. 25.

SHOWING THE OUTTURN OF TORIA VARIETIES GROWN ON TENANTS' AREA AT LYALLPUR AGRICULTURAL STATION DURING 1919.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area in acres.	Treatment.	Date of Sowing.	Date of Harvesting.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	Remarks.
16	3	Early Toria	21	No Bar harrow immediately after sowing	28th August 1919	31st December 1919	1	26	8	12	26	11	
	3a	Ditto		Bar harrow after sowing	Ditto	Ditto	1	16	8	10	30	8	
7	4	Late Toria	160	No Bar harrow after sowing	Ditto	15th January 1920	1	31	0	13	20	15	
	4a	Ditto		Bar harrow after sowing	Ditto	Ditto	1	34	0	14	3	13	
16	1	Early Toria	37	No Bar harrow after sowing	Ditto	31st December 1919	1	36	8	16	21	9	
	1a	Ditto		Bar harrow after sowing	Ditto	Ditto	2	11	8	19	18	6	
14	2	Late Toria	320	No Bar harrow after sowing	Ditto	15th January 1920	1	31	0	15	14	1	
	2a	Ditto		Bar harrow after sowing	Ditto	Ditto	2	0	4	17	14	1	
19	1	Early Toria	49	No Bar harrow after sowing	21st September 1919	28th January 1920	1	33	0	11	36	12	
	1a	Ditto		Bar harrow after sowing	Ditto	Ditto	1	38	0	12	29	6	
	2	Late Toria		No Bar harrow after sowing	Ditto	5th February 1920	2	4	0	13	28	9	
	2a	Ditto		Bar harrow after sowing	Ditto	Ditto	2	12	0	15	0	13	
23	3	Early Toria	320	No Bar harrow after sowing	Ditto	28th January 1920	1	28	0	11	4	1	
	3a	Ditto		Bar harrow after sowing	Ditto	Ditto	2	12	0	15	0	13	
	4	Late Toria		No Bar harrow after sowing	Ditto	5th February 1920	2	7	0	14	8	2	
	4a	Ditto		Bar harrow after sowing	Ditto	Ditto	1	30	0	11	17	2	

Average yield per acre.

													Average yield per acre calculated on yield per acre. Mds.	Srs.	Chks.
1	...	Early Toria	177	No Bar harrow after sowing	...	...	7	4	0	12	33	7	13	2	4
2	...	Ditto		Bar harrow after sowing	...	...	7	38	0	14	14	14	14	19	12
3	...	Late Toria	320	No Bar harrow after sowing	...	...	7	33	0	14	5	14	14	7	11
4	...	Ditto		Bar harrow after sowing	...	...	7	36	4	14	11	12	14	18	15

Average yield per acre without consideration of Bar harrow after sowing and no Bar harrow.

													Mds.	Srs.	Chks.
1	...	Early Toria	177	...	...	...	15	2	0	13	24	2	13	31	0
2	...	Late Toria	160	...	...	...	15	29	4	14	8	13	14	13	5

Statement No. 26.

RESULTS OF HYDRAULIC EXPERIMENTS WITH TORIA GROWN IN SQUARE 10 IN 1919 (LATE SOWN TWO *VERSUS* ONE IRRIGATION).

No. of plot.	No. of sub-plot.	Treatment.	Area in kanals.	Actual outturn. Grain. Maunds.	Grain. Seers.	Straw. Maunds.	Straw. Seers.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Straw. Maunds.	Straw. Seers.	Irrigation in inches for rauni (sowing) dated 16th September 1919.	Irrigation in inches after sowing. Dated 4th November 1919.	Dated 2nd December 1919.	Total inches.	Total irrigation in inches including rauni.	Remarks.
$A_2 a$	$\frac{1}{1}$	Two irrigations	1	1	30	4	38	14	0	39	24	2·47	3·17	2·31	5·48	7·95	
	$\frac{1}{2}$	One irrigation	1	1	32½	4	28	14	20	37	24	2·47	3·17	*Nil.*	3·17	5·64	
	$\frac{2}{1}$	Two irrigations	1	1	36½	5	15	15	12	43	0	2·47	3·17	2·31	5·48	7·95	
	$\frac{2}{2}$	One irrigation	1	1	32	4	31	14	16	38	8	2·47	3·17	*Nil.*	3·37	5·64	
	$\frac{3}{1}$	Two irrigations	1	1	34	4	38	14	32	39	24	2·47	3·17	2·31	5·48	7·95	
	$\frac{3}{2}$	One irrigation	1	2	0	4	17	16	0	35	16	2·47	3·17	*Nil.*	3·37	5·64	
	$\frac{4}{1}$	Two irrigations	1	2	3½	5	29	16	28	45	32	2·47	3·17	2·31	5·48	7·95	
	$\frac{4}{2}$	One irrigation	1	2	15	5	28	19	0	45	24	2·47	3·17	*Nil.*	3·37	5·64	
$A_2 b$	$\frac{1}{1}$	Two irrigations	1	1	17	3	20	11	16	28	0	2·47	3·17	2·31	5·48	7·95	
	$\frac{1}{2}$	One irrigation	1	1	26	4	23	13	8	36	24	2·47	3·17	*Nil.*	3·37	5·64	
	$\frac{2}{1}$	Two irrigations	1	1	20	4	0	12	0	32	0	2·47	3·17	2·31	5·48	7·95	
	$\frac{2}{2}$	One irrigation	1	1	31	4	16	14	8	35	8	2·47	3·17	*Nil.*	3·37	5·64	
	$\frac{3}{1}$	Two irrigations	1	1	37	4	16	15	16	35	8	2·47	3·17	2·31	5·48	7·95	
	$\frac{3}{2}$	One irrigation	1	1	28½	4	26	13	28	37	8	2·47	3·17	*Nil.*	3·37	5·64	
	$\frac{4}{1}$	Two irrigations	1	1	32½	4	34	14	20	38	32	2·47	3·17	2·31	5·48	7·95	
	$\frac{4}{2}$	One irrigation	1	1	32½	4	21	14	20	36	8	2·47	3·17	*Nil.*	3·17	5·64	

Cultivation.

Ploughings—Raja plough 1, country plough ... 2
Sohagings 2
Harrowings 2
Bar harrowing 1
Horse hoeings 5
Dates of sowing—18th September 1919 to 20th September 1919
Date of harvesting—2nd February 1920.

Average outturn per acre.

	Mds.	s.	c.
Two irrigations ...	14	10	8
One irrigation ...	14	37	8

Statement No. 27.

OUTTURN OF 4-F AMERICAN COTTON GROWN IN SQUARE, 27 AREA F_1 DURING KHARIF 1919.

No. of plot.	Treatment.	Area in acres.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Dates of waterings.	Remarks.
$\frac{F_1}{1}$	Farm yard manure at 5 tons per acre ...		0	$25\frac{10}{16}$	6	$16\frac{4}{16}$		
$\frac{F_1}{2}$	Sodium Nitrate at 310 lbs. per acre ...		0	$22\frac{14}{16}$	5	$28\frac{12}{16}$		
$\frac{F_1}{3}$	Control		0	$22\frac{1}{16}$	5	$20\frac{10}{16}$		
$\frac{F_1}{4}$	Bonemeal at 2 cwt. 76 lbs. per acre ...		0	$17\frac{9}{16}$	4	$15\frac{10}{16}$		
$\frac{F_1}{5}$	Potassium Sulphate at 90 lbs. per acre ...		0	$15\frac{14}{16}$	3	$38\frac{13}{16}$		
$\frac{F_1}{6}$	Control		0	$17\frac{11}{16}$	4	$16\frac{14}{16}$		
$\frac{F_1}{7}$	Bonemeal at 2 cwt. 76 lbs. per acre .. Sodium Nitrate at 310 lbs. „ „ ... Potassium sulphate at 90 lbs. „ „ ...	$\frac{1}{16}$th of an acre.	0	$26\frac{5}{16}$	6	$23\frac{9}{16}$		
$\frac{F_1}{8}$	Control		0	$22\frac{7}{16}$	5	$24\frac{9}{16}$	21st June 1919. 11th July 1919. 27th July 1919. 8th September 1919. 21st September 1919. 10th October 1919. 31st October 1919.	
$\frac{F_1}{9}$	Same as 1		0	$26\frac{11}{16}$	6	$26\frac{14}{16}$		
$\frac{F_1}{10}$	Same as 2		0	22	5	20		
$\frac{F_1}{11}$	Control		0	12	3	0		
$\frac{F_1}{12}$	Same as 4		0	$14\frac{5}{16}$	3	$23\frac{-}{16}$		
$\frac{F_1}{13}$	Same as 5		0	$9\frac{14}{16}$	2	$18\frac{10}{16}$		
$\frac{F_1}{14}$	Control		0	$12\frac{4}{16}$	3	$2\frac{8}{16}$		
$\frac{F_1}{15}$	Same as 7		0	$18\frac{9}{16}$	4	$21\frac{14}{16}$		
$\frac{F_1}{16}$	Control		0	$18\frac{-}{16}$	4	$27\frac{8}{16}$		

Cultivation.

Ploughings 1
Harrowings 3
Sohagings 3
Date of sowing—30th April 1919.
Hoeings—5 hoeings to plot 1 to 8 and 4 hoeings to plots 9-16.
Picking began—5th November 1919.
„ finished—15th February 1920.

Statement No. 28.

OUTTURN OF 4-F COTTON GROWN IN SQUARE 27 AREA F_2 DURING KHARIF 1919.

No. of plot	Treatment.	Area in acres.	Actual outturn. Maunds.	Actual outturn. Seers.	Outturn per acre. Maunds.	Outturn per acre. Seers.	No. of waterings 7 on.	Remarks.
$\frac{F_2}{1}$	Farm Yard Manure at 5 tons per acre ...	1/16th of an acre.	0	22	5	20	21st June 1919. 11th July 1919. 27th July 1919. 8th September 1919. 21st September 1919. 10th October 1919. 31st October 1919.	
$\frac{F_2}{2}$	Sodium Nitrate at 310 lbs. per acre ...		0	$23\frac{3}{16}$	5	$31\frac{14}{16}$		
$\frac{F_2}{3}$	Control		0	$34\frac{8}{16}$	8	25		
$\frac{F_2}{4}$	Bonemeal at 2 cwt. 76 lbs. per acre ...		0	$34\frac{9}{16}$	8	$25\frac{10}{16}$		
$\frac{F_2}{5}$	Potassium Sulphate at 90 lbs per acre ...		0	$30\frac{3}{16}$	7	$21\frac{14}{16}$		
$\frac{F_2}{6}$	Control		0	$30\frac{3}{16}$	7	$21\frac{4}{16}$		
$\frac{F_2}{7}$	Bonemeal at 2 cwt. 76 lbs. per acre ... Potassium Sulphate at 90 lbs. „ „ ... Sodium Nitrate at 310 lbs. „ „ ...		0	$34\frac{13}{16}$	8	$27\frac{5}{16}$		
$\frac{F_2}{8}$	Control		0	$31\frac{13}{16}$	7	$37\frac{5}{16}$		
$\frac{F_2}{9}$	Same as 1		0	$26\frac{1}{16}$	6	$20\frac{10}{16}$		
$\frac{F_2}{10}$	Same as 2		0	$16\frac{10}{16}$	4	$6\frac{4}{16}$		
$\frac{F_2}{11}$	Control		0	$12\frac{10}{16}$	3	$6\frac{4}{16}$		
$\frac{F_2}{12}$	Same as 4		0	$14\frac{9}{16}$	3	$21\frac{4}{16}$		
$\frac{F_2}{13}$	Same as 5		0	$18\frac{14}{16}$	4	$28\frac{12}{16}$		
$\frac{F_2}{14}$	Control		1	$5\frac{13}{16}$	11	$18\frac{9}{16}$		
$\frac{F_2}{15}$	Same as 7		2	3	20	30		
$\frac{F_2}{16}$	Control		0	$33\frac{7}{16}$	8	$14\frac{6}{16}$		

Cultivation.

Ploughings 1
Harrowings 4
Sohagings 3
Date of sowing—30th April 1919.
Hoeings (Plot 1 to 8)—5 and (plot 9-16)—4.
Picking began—5th November 1919.
Picking finished—5th February 1920.

Statement No. 29.

RESULTS OF GREEN MANURING WITH GUARA FOR WHEAT (TYPE 1) IN AREA C, SQUARE 2, RABI 1919-20.

No. of Square and Block.	No. of plot	Treatment.	Area.		Actual outturn.				Outturn per acre.				No of irrigations with dates.	Remarks.
					Grain.		*Straw.*		*Grain.*		*Straw.*			
			Kanals.	Marlas.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.		
C 2	1	Guara burried in on 7th September 1919.	7	8 1/2	21	0	24	0	22	25	25	11 34/32	Three on— 20th December 1919, 27th February 1920, and 27th March 1920.	
	2	Fallow	7	3 9/10	13	32	17	14	15	12 13/16	19	10 11/16	In 2, 3 and 4 plots— 3rd irrigation on 30th March 1920.	
	3	Same as one	7	9	14	36	18	15	16	0	19	29 4/16		
	4	Same as 2	7	5 4/15	11	35	18	34	13	3 3/16	20	30 7/16		

Cultivation.

		Plots 2 and 4. Fallow.
Ploughings	Raja plough	1
	Country plough	4
Harrowings	Horse hoes	6
	Bar harrows	4
Sohagings		6
Waterings		3

Levelling with sohaga for two days in plots 2 and 4.

Date of sowing Guara — 1st July 1919

Date of sowing wheat — 12th November 1919

Date of harvesting — 25th April 1920.

Average yields per acre.

Plots 1 and 3. Till burrying in Guara.	*Plots 1 and 3.* After burrying Guara.		Mds.	Srs.	Ch.
1	*Nil*	Guara burried ...	19	12	8
Nil	2	Fallow	14	8	8
1	3				
1	4				
3	4				
1	3				

Statement No. 30.

SHOWING THE RESULTS OF GREEN MANURING WITH WHEAT PUNJAB TYPE 11, IN TENANTS' AREA, DURING RABI 1919-20.

No. of square, plot and sub-plot.	Treatment.	Area.		Actual outturn of grain.			Actual outturn of Bhusa.			Outturn per acre of grain.			Outturn per acre of Bhusa.			No. of square plot and sub-plot.	Treatment.	Area.		Actual outturn of grain.			Actual outturn of Bhusa.			Outturn per acre of grain.			Outturn per acre of Bhusa.			Date of sowing.	No. of irrigations with dates.	Remarks.
		Kanals.	Marlas.	Maunds.	Seers	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds	Seers.	Chataks.			
13—1 19	San ploughed in on 24th August 1919.	4	10	12	28	8	21	1	8	22	24	0	37	16	...	13—2 19	Guara ploughed in on 24th August 1919.	4	10	12	11	8	18	5	8	21	33	12	32	9	12	16th and 17th November 1919.	6th January 1920, 23rd February 1920 and 20th March 1920.	
13—1 20	Ditto	4	6½	9	11	...	12	33	...	17	6	3	23	10	6	13—2 20	Ditto ...	4	6½	9	33	6	14	38	8	18	7	7	27	27	1	Do.	Ditto.	
13—1 21	San ploughed in on 25th August 1919.	4	3½	9	6	...	16	10	...	17	21	5	31	5	8	13—2 21	Guara removed on 25th August 1919.	4	3½	7	5	8	11	24	8	13	27	1	22	10	1	Do.	Ditto.	
13—1 22	Ditto	4	6½	11	38	8	18	16	8	22	5	1	34	2	5	13—2 22	Ditto ...	4	6½	5	33	8	8	31	8	10	31	14	16	10	3	Do.	Ditto.	
	Average yield per acre.																																	
1	San ploughed in (plots 19, 20).	8	16½	21	39	8	...	...	...	19	37	½	...	...	...	—	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	Guara ploughed in (plots 19, 20).	8	16½	22	5	...	...	...	...	20	2	4	...	...	...	—	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	Guara removed (plots 21, 22).	8	10	12	39	...	...	...	...	12	9	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4	San ploughed in (plots 21, 22).	8	10	21	4	8	...	...	...	19	34	13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Statement No. 31.

SHOWING THE EFFECT OF EARLY AND LATE GREEN MANURING WITH GUARA AGAINST FALLOW FOR WHEAT TYPE 11, GROWN IN TENANTS' AREA, DURING RABI 1919-20.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chataks.	Actual outturn of Bhusa. Maunds.	Actual outturn of Bhusa. Seers.	Actual outturn of Bhusa. Chataks.	Outturn per acre of grain. Maunds.	Outturn per acre of grain. Seers.	Outturn per acre of grain. Chataks.	Outturn per acre of Bhusa. Maunds.	Outturn per acre of Bhusa. Seers.	Outturn per acre of Bhusa. Chataks.	Date of sowing.	No. of watering with dates.	Remarks.
7 / 12	1	Fallow ..	2	1	4	8	0	9	12	0	16	15	3 9/41	36	11	13 11/41	2nd November 1919.	11th December 1919, 17th February 1920 and 6th April 1920.	Germination good, crop fairly good.
	2	Early green manuring with guara.	2	1	3	39	0	8	4	0	15	20	33 7/41	31	24	10 6/41			Germination good, crop good.
	3	Fallow ...	2	1	4	18	0	7	35	0	17	14	6 10/41	30	29	12 4/41			Germination good, crop fairly good.
	4	Late green manuring with guara.	2	1	5	4	0	10	30	0	19	36	23 1/41	41	38	32 / 41			Germination good, crop good.
		AVERAGE YIELD PER ACRE.																	AVERAGE YIELD PER ACRE CALCULATED ON YIELD PER ACRE. Mds. Srs. Chtks.
	1	Fallow ...	4	2	8	26	0	...	..	...	16	35	2	...	...	...			16 35 2
	2	Early green manuring with guara.	2	1	3	39	0	...	...	...	15	20	8	...	...	..			15 20 8
	3	Late green manuring with guar .	2	1	5	4	0	...	...	...	19	36	2	..	...	...			19 36 2

Statement No 32.

RESULTS OF NITRATES OF SODA ON WHEAT (TYPE 11) GROWN IN SQARE 7, RABI 1919-20, NITRATE OF SODA AT 1 CWT. AND 1½ CWT. *VERSUS* UNMANURED.

No. of Square and Killa.	No. of plot.	Application of Nitrate of Soda per acre.	MANURED. Outturn per acre. Grain. Maunds.	Grain. Seers.	Straw. Maunds.	Straw. Seers.	No. of Square and Killa.	No. of plot	UNMANURED. Outturn per acre. Grain. Maunds.	Grain. Seers.	Straw. Maunds.	Straw. Seers.	Increase per acre. Grain. Maunds.	Grain. Seers.	Straw. Maunds.	Straw. Seers.	Increased value of grain at Rs. 4-8-0 per maund and that of Bhusa at Re. 1 per maund.				Expenditure on Nitrate of Soda at Rs. 23 per cwt.			Gain.			Remarks
																			Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	
7 / 3	2	1 1/2 cwt.	19	10	35	22	7 / 8	1	13	20	23	24	5	30	11	38	Grain ...		25	14	0	34	8	0	3	5	3	
																	Bhusa ...		11	15	3							
																	Total ...		37	13	3							
7 / 9	1	1 cwt.	22	0	37	12	7 / 9	2	14	36	24	26	7	4	12	26	Grain ...		31	15	3	23	0	0	21	9	8	
																	Bhusa ...		12	10	5							
																	Total ...		44	9	8							

CULTIVATION.

Ploughings ... { Raja ... ... 1; Country plough 3

Sohagings 4

Levelling with sohaga for 2 days.

Harrowings ... { Horse hoes ... ... 4; Bar harrows 3

Waterings .. 3 on 20th December 1919, 26th February 1920, 27th March 1920.

Nitrate of Soda applied with 1st watering on 19th December 1919.

Date of sowing—13th November 1919.

Date of harvesting—26th April 1920.

Statement No. 33.

COMPARATIVE VARIETAL TESTS OF WHEAT TYPES 8-A AND PUNJAB 11 IN SQUARE 26, RABI 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Previous crop.	Dates of waterings.	Remarks.
A-2 1	a 1	8-A ...	¼th of an acre.	8	27	0	17	8	0	34	28	0	68	32	0	Cotton.	24th November 1919. 22nd February 1920. 16th March 1920.	
	a 2	Pb.-XI ...		9	19	0	17	34	0	37	36	0	71	16	0			
	b 1	8-A ...		7	23	0	13	37	0	30	12	0	55	28	0			
	b 2	Pb.-XI ...		8	21	8	14	23	8	34	6	0	58	31	0			
A 2 2	a 1	8-A ...		7	20	6	15	16	10	30	1	8	61	26	8			
	a 2	Pb.-XI ...		8	22	10	13	25	6	34	10	8	54	21	8			
	b 1	8-A ...		8	34	10	16	37	6	35	18	8	67	29	8			
	b 2	Pb.-XI ...		9	22	10	16	34	6	38	10	8	67	17	8			
A 2 3	a 1	8-A ...		9	4	14	17	5	2	36	19	8	68	20	8			
	a 2	Pb.-XI ...		9	5	0	14	34	0	38	20	0	59	16	0			
	b 1	8-A ..		9	21	14	16	34	2	38	7	8	67	16	8			
	b 2	Pb.-XI ...		9	3	4	17	4	12	36	13	...	68	19	0			

		Grain. Mds.	Srs.	Chtks.	Bhusa. Mds.	Srs	Chtks.
Average yield per acre of early sown 8-A	...	34	7	13⅓	64	28	13⅓
Ditto ditto Pb.-XI	...	36	9	5⅓	63	14	0

Ploughings ... 4
Sohagings ... 8
Harrowings ... 12
Surface harrowings and weeding. 4

Date of sowing—1st of November 1919.
Date of harvesting—19th April to 28th April 1920.

Statement No. 34.

COMPARATIVE VARIETAL TESTS OF WHEAT TYPES 8-A AND PUNJAB 11, 1919-20 (LATE SOWN).

No. of square and plot.	No. of sub-plot.	Name of variety.	Area in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Previous crop.	Dates of waterings.	Remarks
A 1 26—1	a 1	8-A ...	¼th of an acre.	4	29	4	7	18	12	18	37	0	29	35	0	Wheat.	1st February 1920. 4th March 1920. 30th March 1920.	Yield of sub-plot A 1 — 2 was not included in calculating average as some Dhulras (little heaps of earth with grain mixed with them collected by sweeping the threshing floor) got wet and germinated due to an accidental breakage of water. About 10 per cent. plants withered in April on account of continuous wind and heat which were attacked by white ants.
	a 2	Pb.-XI ...		5	10	4	7	14	12	21	1	0	29	19	0			
	b 1	8-A ...		4	31	12	7	35	4	19	7	0	31	21	0			
	b 2	Pb.-XI ...		5	18	8	8	17	8	21	34	0	33	30	0			
A 1 2	a 1	8-A ...		4	16	4	9	3	12	17	25	0	36	15	0			
	a 2	Pb.-XI ...		5	6	6	7	3	10	20	25	8	28	14	8			
	b 1	8-A ...		5	23	4	8	5	12	22	13	0	32	23	0			
	b 2	Pb.-XI ...		5	31	2	8	31	14	23	4	8	35	7	8			
A 1 3	a 1	8-A ...		5	33	8	8	5	8	23	14	0	32	22	0			
	a 2	Pb.-XI ...		5	13	12	7	3	4	21	15	0	28	13	0			
	b 1	8-A ...		5	12	0	8	34	0	21	8	0	35	16	0			
	b 2	Pb.-XI ...		5	12	4	7	32	12	21	9	0	31	11	0			

		Grain. Mds.	Srs.	Chtks.	Bhusa. Mds.	Srs.	Chtks.	
Average yield of late sown Pb.-XI	...	21	21	8	31	2	8	Sown on 7th December, 1919.
Average yield of late sown 8-A	...	20	39	13	32	15	6	Harvested on 29th April 1920

Ploughing ... 8
Harrowings ...10
Sohaging ... 4
Surface harrowings and weedings 5

Statement No. 35.

BLOCK C, EARLY SOWN WHEAT.

STATEMENT SHOWING THE COMPARATIVE TESTS OF PUNJAB-11 AND 8-A SOWN ON 1ST AND 2ND NOVEMBER IN THE NEW AREA WITH TWO AND THREE IRRIGATION, RESPECTIVELY.

Statement

BLOCK C, EARLY

STATEMENT SHOWING THE COMPARATIVE TESTS OF PUNJAB 11 AND 8-A SOWN ON 1ST AND 2ND

TWO IRRIGATIONS ON 1ST DECEMBER 1919 AND 28RD FEBRUARY 1920.

No. of square, block and plot.	No. of sub-plot.	Variety.	Area in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Shataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Remarks.
	a	Punjab XI ...		4	27	14	9	15	10	31	22	8	63	4	2	Lodging 7 %.
	b	„ 8-A ...		4	23	8	10	1	8	30	33	2	67	18	1	„ 21 %.
32	*c*	„ XI ...	25	4	15	10	8	10	14	29	20	3	55	23	6	„ 5 %.
—1	*d*	„ 8-A ...		4	7	2	9	28	6	28	3	1	65	9	14	„ 15 %.
C	*e*	„ 8-A ...	168	4	6	4	9	38	12	27	37	3	66	39	10	„ 15 %.
	f	„ XI ...		4	8	0	7	21	0	28	8	15	50	22	12	„ 15 %.
	a	„ XI ...		4	29	8	9	12	8	31	33	7	61	23	3	Lodging 17·5 %.
	b	„ 8-A ...		4	20	12	9	12	4	30	14	10	62	21	8	„ 15·1 %.
32	*c*	„ XI ...	25	4	26	0	8	14	0	31	9	15	56	4	8	„ 13 %.
—3	*d*	„ 8-A ...		4	14	14	8	35	2	29	15	3	59	26	7	„ 16·5 %.
C	*e*	„ XI ...	168	4	22	0	8	14	0	30	23	1	56	4	8	„ 7·5 %.
	f	„ 8 A ...		4	23	8	9	12	8	30	33	2	62	23	3	„ 32·5 %.
	a	„ XI ...		4	4	8	7	31	8	27	25	7	52	13	5	Lodging 2 %.
	b	„ 8-A ...		4	7	0	8	12	0	28	2	4	55	31	1	„ 8 %.
32	*c*	„ XI ...	25	4	18	4	8	24	13	29	37	13	57	36	12	„ ·5 %.
—5	*d*	„ 8-A ...		4	20	0	8	28	0	30	9	10	58	18	9	„ 4·5 %.
C	*e*	„ XI ...	168	4	19	0	8	13	0	30	2	14	55	37	10	„ 2 %.
	f	„ 8 A ...		4	17	14	8	15	4	29	34	8	56	12	14	„ 4 %.

	Grain. Maunds.	Seers.	Chataks.
Average yield of Punjab XI	30	2	11
Ditto ditto 8-A	29	20	5

Cultivation :—
Raja plough ... ...
Desi plough ... ...
Harrowing ... ...
Surface harrowing ... ...
Sohaging ... ...
Date of sowing—1st and 2nd November
Date of harvesting—26th and 30th April

Statement

BLOCK B, LATE

STATEMENT SHOWING THE COMPARATIVE VARIETAL TESTS OF PUNJAB X1 AND 8-A SOWN ON 5TH

TWO IRRIGATIONS ON 23RD FEBRUARY 1920 AND 16TH MARCH 1920.

No. of square, block and plot.	No. of sub-plot.	Variety.	Area in acre.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Remarks.
	a	Punjab XI ...		4	2	14	5	11	2	27	14	8	35	18	12	
	b	„ 8-A ...		4	4	14	6	33	2	27	27	15	45	35	6	
32	*c*	„ XI ...	25	4	3	0	6	2	0	27	15	6	40	26	4	
—1	*d*	„ 8-A ...		4	29	4	5	27	12	31	31	12	38	10	8	
B	*e*	„ XI ...	168	3	23	8	5	32	8	24	4	5	39	2	6	
	f	„ 8-A ...		3	25	0	5	35	0	26	1	9	39	19	3	
	a	„ XI ...		3	25	0	6	8	0	24	14	6	41	26	9	
	b	„ 8-A ...		3	20	12	6	37	4	23	25	13	46	23	1	
32	*c*	„ XI ...	25	3	12	0	6	28	3	22	7	1	45	0	15	
—3	*d*	„ 8-A ...		3	15	10	6	17	6	22	31	6	43	9	9	
B	*e*	„ XI ...	168	3	13	14	5	28	2	22	19	10	38	13	0	
	f	„ 8-A ...		3	21	4	6	20	12	28	29	3	43	32	4	
	a	„ XI ...		3	24	12	8	15	4	24	12	12	42	35	5	
	b	„ 8-A ...		3	29	10	7	21	6	25	5	8	50	25	4	
32	*c*	„ XI ...	25	3	15	10	6	1	6	22	31	6	40	22	1	
—5	*d*	„ 8-A ...		3	18	12	6	26	4	23	12	6	44	29	3	
B	*e*	„ XI ...	168	3	6	12	6	2	4	21	11	12	40	28	0	
	f	„ 8-A ...		3	12	2	6	22	14	22	7	14	44	6	8	

	Grain. Maunds.	Seers.	Chataks.
Average yield per acre of Punjab XI	24	1	$3\frac{7}{9}$
Ditto ditto 8-A	25	5	$14\frac{8}{9}$

Cultivation :—
Raja plough ... ...
Desi plough ... ...
Harrowing ... ...
Surface harrowing 5 in Plots Nos.
Sohaging ... ...
Date of sowing—
Date of harvesting—

No. 35.

SOWN WHEAT.

NOVEMBER IN THE NEW AREA WITH TWO AND THREE IRRIGATION, RESPECTIVELY.

THREE IRRIGATIONS ON 1st DECEMBER 1919, 23RD FEBRUARY 1920 AND 17TH MARCH 1920.

No. of square, block and plot.	No. of sub-plot.	Variety.	Area in acres.	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Remarks.
	a	Punjab XI ...		5	3	10	8	29	6	34	8	6	58	27	13	Lodging 4 %.
	b	,, 8-A ...		4	20	2	9	7	14	30	10	7	61	32	3	,, 23 %.
32	*c*	,, XI ...	25	5	7	0	9	25	0	34	31	1	64	27	3	,, 11 %.
—2	*d*	,, 8-A ...	—	4	32	0	10	0	0	32	10	4	67	8	0	,, 30 %.
B	*e*	,, XI ...	168	4	31	4	8	25	12	32	5	3	58	3	7	,, 16 %.
	f	,, 8-A ...		4	31	10	9	5	6	32	7	14	61	15	5	,, 37 %.
	a	,, XI ...		4	23	12	8	27	4	30	34	13	58	13	8	Lodging 9·5 %.
	b	,, 8-A ...		4	21	0	8	36	0	30	16	5	59	32	5	,, 34·5 %.
32	*c*	,, XI ...	25	4	18	12	8	6	4	30	1	3	54	32	6	,, 6 %.
—4	*d*	,, 8 A ...	—	4	7	12	8	12	4	28	7	4	55	32	12	,, 30 %.
B	*e*	,, XI ...	168	4	17	12	8	5	4	29	34	8	54	25	1	,, 11·5 %.
	f	,, 8-A ...		4	24	12	8	33	4	31	1	8	60	7	7	,, 37 %.
	a	,, XI ...		4	35	12	8	4	4	32	35	7	54	18	15	Lodging 6·5 %.
32	*b*	,, 8 A ...	25	4	8	12	7	32	4	28	14	0	52	18	5	,, 20 %.
—6	*c*	,, XI ...	—	4	28	10	8	27	6	31	27	9	58	14	6	,, 3 %.
B	*d*	,, 8-A ...	168	4	25	8	8	10	8	31	6	9	55	20	15	,, 19 %.

	Grain. Maunds.	Seers.	Chataks.
Average yield of Punjab XI	32	2	5
Ditto ditto 8-A	30	19	4

... ... 1
... ... 6
... ... 8
... ... 4
... ... 6

1919.

1920.

No. 36.

SOWN WHEAT.

AND 6TH DECEMBER 1919 IN THE NEW AREA WITH TWO AND THREE IRRIGATION, RESPECTIVELY.

THREE IRRIGATIONS ON 5TH FEBRUARY 1920, 4TH MARCH 1920 AND 30TH MARCH 1920.

No. of square, block and plot.	No. of sub-plot.	Variety.	Area in acres.	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Remarks.
	a	Punjab XI ...		3	25	12	5	18	4	24	19	7	36	26	10	
	b	,, 8-A ...		3	20	12	5	39	4	23	25	13	40	7	12	
32	*c*	,, XI ...	25	3	15	0	5	8	0	22	27	3	34	37	12	
—2	*d*	,, 8-A ...	—	3	16	4	6	3	12	22	35	10	40	38	0	
B	*e*	,, XI ...	168	3	22	8	6	1	8	23	37	10	40	22	14	
	f	,, 8-A ...		3	26	12	6	16	4	24	26	8	43	2	0	
	a	,, XI ...		3	27	8	6	9	8	24	31	3	41	36	10	
	c	,, 8-A ...		3	11	12	6	39	4	22	5	6	46	36	9	
32	*b*	,, XI ...	25	3	13	12	5	21	4	22	18	13	37	13	8	
—4	*d*	,, 8-A ...	—	3	13	8	6	12	8	22	17	2	42	16	13	
B	*e*	,, XI ...	168	3	25	4	5	6	12	24	16	13	34	29	6	
	f	,, 8-A ...		3	13	4	6	24	12	22	15	7	44	19	2	
	a	,, XI ...		3	29	2	6	20	14	25	3	2	43	33	1	
	b	,, 8-A ...		3	33	2	7	16	14	25	29	0	49	35	0	
32	*c*	,, XI ...	25	3	29	2	7	5	14	25	2	2	48	1	1	
—6	*d*	,, 8-A ...	—	3	39	8	7	19	8	26	31	13	50	12	10	
B	*e*	,, XI ...	168	3	26	12	6	12	4	24	26	3	42	15	1	
	f	,, 8-A ...		3	29	8	6	33	8	25	4	10	45	37	14	

	Grain. Maunds.	Seers.	Chataks.
Average yield per acre of Punjab XI ...	24	6	13
Ditto ditto 8-A ...	23	39	0

... ... 1
... ... 4
... ... 5
1, 3 and 5 but 4 in Plots Nos. 2, 4 and 6.
... ... 5
5th and 6th December 1919.
2du and 6th May 1920.

Statement No. 37.

COMPARATIVE VARIETAL TESTS OF EARLY SOWN WHEATS (TYPES Nos. 11 AND 8-A) ON GOOD LAND WITH THREE IRRIGATIONS GROWN IN TENANTS' AREA DURING RABI 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Date of sowing.	Dates of irrigations.	Remarks.
5	1	Type XI ...	2	3	9	10	0	34	16	12	31st October 1919	15th December 1919, 24th February 1920 and 19th March 1920.	Germination good, crop good, lodging cent per cent., land getting somewhat poor from strip 1-4.
21	2	8-A ...	2	3	8	37	8	33	10	4	Ditto	Ditto	Ditto
	3	Type XI ...	2	3	10	9	0	38	1	14	Ditto	Ditto	Ditto
	4	8-A ...	2	3	8	26	0	32	7	7	Ditto	Ditto	Ditto
16	1	Type XI ...	1	19	8	9	9	33	31	13	Ditto	7th January 1920, 23rd February 1920 and 18th March 1920.	Germination rather thin, crop good, lodging cent per cent.
12	2	8-A ...	1	19	8	19	0	34	30	12	Ditto	Ditto	Ditto
	3	Type XI ...	1	16	7	39	0	32	28	11	Ditto	Ditto	Ditto
	4	8-A ...	1	19	8	10	0	33	33	14	Ditto	Ditto	Ditto
17	1	Type XI ...	2	4	9	16	8	34	9	1	1st November 1919.	10th January 1920 25th February 1920 and 19th March 1920.	Germination good, crop good, lodging cent per cent.
20	2	8-A ...	2	4	10	26	0	38	29	1	Ditto	Ditto	Ditto
	3	Type XI ...	2	4	10	4	8	36	30	15	Ditto	Ditto	Ditto
	4	8-A ...	2	4	10	10	0	37	10	15	Ditto	Ditto	Ditto
19	1	Type XI ...	2	8	10	15	0	34	23	5	30th October 1919.	14th December 1919, 29th February 1920 and 18th March 1920.	Germination good, crop good, lodging cent per cent.
13	2	8-A ...	2	8	10	22	0	35	6	11	Ditto	Ditto	Ditto
	3	Type XI ...	2	8	10	2	0	30	20	0	Ditto	Ditto	Ditto
	4	8A ...	2	8	10	28	0	35	26	11	Ditto	Ditto	Ditto

AVERAGE YIELD PER ACRE—

1	Type XI ...	17	8	75	25	8	34	31	½
2	8-A ...	17	8	76	18	8	35	6	3

AVERAGE YIELD PER ACRE CALCULATED ON YIELD PER ACRE.

	Mds.	Srs.	Chtks.
Type XI	34	30	5
28-A	35	4	7

Statement No. 38.

COMPARATIVE VARIETAL TESTS OF EARLY SOWN WHEATS (TYPE XI AND 8-A) ON A GOOD LAND WITH TWO IRRIGATIONS, GROWN IN TENANTS' AREA DURING RABI 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Date of sowing.	Dates of irrigations.	Remarks.
13	1	Type XI ...	2	1	7	35	8	30	31	3	31st October 1919.	6th January 1919 and 6th March 1920.	Germination good, crop good.
12	2	8-A ...	2	1	7	5	8	27	34	2	Ditto	Ditto	Ditto
	3	Type XI ...	2	1	7	1	8	27	18	8	Ditto	Ditto	Ditto
	4	8-A ...	2	1	6	21	0	25	18	8	Ditto	Ditto	Ditto
13	1	Type XI ...	2	4½	8	11	0	29	36	13	Ditto	14th December 1919, 6th March 1920.	Germination good' crop good, lodging cent per cent.
17	2	8-A ...	2	4½	10	11	0	37	6	1	Ditto	Ditto	Ditto
	3	Type XI ...	2	4½	9	6	8	33	5	3	Ditto	Ditto	Ditto
	4	8-A ...	2	4½	8	17	0	30	18	8	Ditto	Ditto	Ditto
16	1	Type XI ...	2	1	6	0	0	23	16	9	Ditto	7th January 1920, 6th March 1920.	Germination good, crop good.
16	2	8-A ...	2	1	5	17	0	21	6	13	Ditto	Ditto	Ditto
	3	Type XI ...	2	1	5	32	8	22	27	5	Ditto	Ditto	Ditto
	4	8-A ...	2	1	6	27	0	26	1	15	Ditto	Ditto	Ditto
17	1	Type XI ...	2	1¾	7	31	8	29	34	5	1st November 1919.	8th January 1920, 7th March 1920.	Germination good, crop good.
22	2	8-A ...	2	1¾	6	32	0	26	2	6	Ditto	Ditto	Ditto
	3	Type XI ...	2	1¾	7	37	0	30	14	13	Ditto	Ditto	Ditto
	4	8-A ...	2	1¾	6	35	0	26	13	14	Ditto	Ditto	Ditto

AVERAGE YIELD PER ACRE—

1	Type XI ...	16	13	59	35	8	28	20	11
2	8-A ...	16	16	58	5	8	27	27	6

AVERAGE YIELD PER ACRE CALCULATED ON YIELD PER ACRE.

	Mds.	Srs.	Chtks.
Type XI	28	18	1
28-A	27	22	12

Statement No. 39.

COMPARATIVE VARIETAL TESTS OF EARLY SOWN WHEATS (TYPE XI AND 8-A) ON LIGHT LAND WITH THREE IRRIGATIONS, GROWN IN TENANTS' AREA DURING RABI 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Date of sowing.	Dates of irrigations.	Remarks.
7 / 19	1	Type XI ...	2	2¾	7	5	0	26	26	10⅔	2nd November 1919.	11th December 1919, 28th February 1920 and 26th March 1920.	Germination good, crop good.
	2	8-A ...	2	2¾	8	8	8	30	29	7	Ditto	Ditto	Ditto
	3	Type XI ...	2	2¾	7	1	0	23	11	11	Ditto	Ditto	Ditto
	4	8-A ...	2	2¾	4	34	8	18	7	15	Ditto	Ditto	Germination good, crop fair (bad attack of white ants).
12 / 1	1	Type XI ...	1	17½	6	0	0	25	24	0	31st October 1919.	12th December 1919, 24th February 1920, and 18th March 1920.	Germination good, crop good.
	2	8-A	1	17½	5	1	0	21	17	9⅗	Ditto	Ditto	Germination good, suffered from an attack of white ants.
	3	Type XI ...	1	17½	5	4	0	21	30	6⅗	Ditto	Ditto	Ditto
	4	8-A ...	1	17½	5	35	0	25	2	10⅖	Ditto	Ditto	Ditto
12 / 3	1	Type XI ...	1	17½	4	34	0	20	37	11	Ditto	12th December 1919, 24th February 1920 and 19th March 1920.	Germination good, crop fair.
	2	8-A ...	1	17½	4	2	0	17	8	0	Ditto	Ditto	Germination good (suffered from an attack of white ants.
	3	Type XI ...	1	17½	4	34	0	20	37	11	Ditto	Ditto	Ditto
	4	8-A ...	1	17½	4	38	0	21	4	12⅘	Ditto	Ditto	Ditto
Average yield per acre—	1	Type XI ...	11	15½	34	38	0	23	28	13			
	2	8-A ...	11	15½	32	39	0	22	16	2			

Average yield per acre calculated an yield per acre.

	Mds.	Srs.	Chtks.
1 Type XI	23	28	0
2 8-A	22	11	12

Statement No. 40.

COMPARATIVE VARIETAL TESTS OF EARLY SOWN WHEATS (TYPE XI AND 8-A) ON LIGHT LAND WITH TWO IRRIGATIONS, GROWN IN TENANTS' AREA DURING RABI 1919-20.

No. of square and plot.	No. of sub plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Dates of irrigations.	Date of sowing.	Remarks.
3 / 13	1	Type XI ...	2	2	5	22	8	21	7	10	17th December 1919, 28th February 1920.	1st November 1919.	Germination good, crop good.
	2	8-A ...	2	2	5	29	8	21	34	5	Ditto	Ditto	Ditto
	3	Type XI ...	2	2	6	28	8	25	22	14	Ditto	Ditto	Ditto
	4	8-A ...	2	2	6	32	8	25	33	1	Ditto	Ditto	Ditto
8 / 11	1	Type XI ...	1	18	4	28	8	19	33	11	4th December 1919, 6th March 1920.	31st October 1919.	Germination good, crop fair.
	2	8-A ...	1	18	5	5	0	21	23	3	Ditto	Ditto	Ditto
	3	Type XI ...	1	18	4	27	0	19	27	6	Ditto	Ditto	Ditto
	4	8-A ...	1	18	5	28	0	24	0	0	Ditto	Ditto	Germination good, crop fair except 10, marlas which were dried up.
12 / 14	1	Type XI ...	1	19	3	31	0	15	19	8	12th December 1919, 6th March 1920.	31st October 1919	Germination good, crop fair.
	2	8-A ...	1	19	4	1	0	16	21	8	Ditto	Ditto	Ditto
	3	Type XI ...	1	19	4	32	0	19	27	11	Ditto	Ditto	Ditto
	4	8-A ...	1	19	5	7	0	21	9	4	Ditto	Ditto	Ditto
Average yield per acre—	1	Type XI ...	11	18	30	9	8	20	13	1			
	2	8-A ...	11	18	32	23	0	21	35	15			

Average yield per acre calculated on yield per acre.

	Mds.	Srs.	Chtks.
1 Type XI	20	9	12⅔
2 8-A	21	34	6

Statement No. 41.

COMPARATIVE VARIETAL TESTS OF LATE SOWN WHEATS (TYPE 11 AND 8-A) ON GOOD LAND WITH TWO IRRIGATIONS, GROWN IN TENANTS' AREA, DURING RABI, 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area		Actual outturn.			Outturn per acre.			Date of sowing.	Dates of irrigations.	Remarks.
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
5 / 12	1	Type 11 ...	2	4¾	7	8	0	25	29	12	29th November 1919	31st January 1920 and 6th March 1920.	Germination good, crop good.
	2	8-A ...	2	4¾	7	21	8	26	37	15	Ditto	Ditto	Ditto.
	3	Type 11 ...	2	4¾	7	8	0	25	29	12	Ditto	Ditto	Ditto.
	4	8-A ...	2	4¾	7	15	0	26	14	12	Ditto	Ditto	Ditto.
13 / 7	1	Type 11 ...	2	5½	6	5	8	21	23	4	29th November 1919	31st January 1920 and 6th March 1920	Germination good, crop fairly good.
	2	8-A ...	2	5½	6	18	0	22	27	4	Ditto	Ditto	Ditto.
	3	Type 11 ...	2	5½	6	7	0	24	14	1	Ditto	Ditto	Ditto.
	4	8-A ...	2	4	6	8	0	22	21	13	Ditto	Ditto	Ditto.
16 / 21	1	Type 11 ...	2	2	5	16	0	20	22	13	28th November 1919	31st January 1920 and 6th March 1920.	Germination good, crop fair.
	2	8-A ...	2	2	6	1	8	23	0	0	Ditto	Ditto	Ditto.
	3	Type 11 ...	2	2	6	30	0	25	28	9	Ditto	Ditto	Ditto.
	4	8-A ...	2	2	5	10	8	20	1	14	Ditto	Ditto	Ditto.
19 / 18	1	Type 11 ...	2	8	9	1	0	30	3	5	30th November 1919	31st January 1920 and 6th March 1920.	Germination good, crop good.
	2	8-A ...	2	8	8	35	0	29	23	5	Ditto	Ditto	Ditto.
	3	Type 11 ...	2	8	8	24	0	28	26	10	Ditto	Ditto	Ditto.
	4	8-A ...	2	8	8	38	8	29	35	0	Ditto	Ditto	Ditto.

		Average yield per acre.								Average yield per acre calculated on yield per acre.			
											Mds.	Srs.	Chtks.
1	Type 11 ...	18	½	57	9	8	25	16	2	1 Type 11	25	12	4
2	8-A ...	17	19	56	28	0	25	10	12	2 8-A	25	5	4

Statement No. 42.

COMPARATIVE VARIETAL TESTS OF LATE SOWN WHEATS (TYPE XI AND 8-A) ON A GOOD LAND WITH THREE IRRIGATIONS GROWN IN TENANTS' AREA DURING RABI, 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area.		Actual outturn.			Outturn per acre			Dates of irrigations.	Date of sowing.	Remarks.
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
5 / 1 / 20	1	Type XI ...	2	4	5	11	0	19	7	4	1st February 1920 1st March 1920 and 6th April 1920.	29th November 1919.	Germination good, crop fair.
	2	8-A ...	2	4	4	23	8	15	27	4	Ditto	Ditto	Germination good, (white ants attack.)
	3	Type XI ...	2	4	6	27	8	24	12	11	Ditto	Ditto	Germination good, crop fair.
	4	8-A ...	2	4	6	37	8	25	9	1	Ditto	Ditto	Ditto.
13 / 14	1	Type XI ...	2	½	7	12	8	28	35	8	31st January 1920, 1st March 1920 and 7th April 1920.	24th November 1919.	Germination good, crop good.
	2	8-A ...	2	½	6	35	0	27	6	6	Ditto	Ditto	Ditto.
	3	Type XI ...	2	½	7	22	8	29	35	1	Ditto	Ditto	Ditto.
	4	8-A ...	2	½	5	23	0	22	0	15	Ditto	Ditto	Ditto.
16 / 15	1	Type XI ...	1	17½	4	38	0	21	4	12	30th January 1920, 23rd February 1920 and 6th April 1920.	24th November 1919.	Germination good, crop fair.
	2	8-A ...	1	17½	5	22	0	23	27	3	Ditto	Ditto	Ditto.
	3	Type XI ...	1	17½	4	28	8	20	4	4	Ditto	Ditto	Ditto.
	4	8-A ...	1	17½	4	13	0	18	18	2	Ditto	Ditto	Ditto.
17 / 12	1	Type XI ...	2	¾	7	21	0	29	21	13	1st February 1920, 27th February 1920 and 27th March 1920	29th November 1919.	Germination good, crop good.
	2	8-A ...	2	¾	7	29	0	30	13	4	Ditto	Ditto	Ditto.
	3	Type XI ...	2	¾	6	28	8	26	14	3	Ditto	Ditto	Ditto.
	4	8-A ...	2	¾	8	18	0	33	7	1	Ditto	Ditto	Ditto.

		Average yield per acre.								Average yield per acre calculated on yield per acre.			
											Mds.	Srs.	Chtks.
1	Type XI ...	16	51½	50	29	8	24	37	8	1 Type XI	24	36	15
2	8-A ...	16	51½	50	1	0	24	23	9	2 8-A	24	23	10

Statement No. 43.

COMPARATIVE VARIETAL TESTS OF LATE SOWN WHEATS (TYPE XI AND 8-A) ON LIGHT LAND, WITH THREE IRRIGATIONS, GROWN IN TENANTS' AREA DURING RABI, 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area.		Actual outturn.			Outturn per acre.			Date of sowing.	Dates of irrigations.	Remarks.
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks			
3 / 18	1	Type XI ...	2	1½	7	27	0	29	23	9	7th December 1919	5th February 1920, 28th February 1920 and 27th March 1920.	Germination good, crop fairly good, land getting poorer from strips 1—4.
	2	8-A ...	2	1⅓	7	29	0	29	31	5	Ditto	Ditto	Ditto.
	3	Type XI ...	2	1½	7	3	8	27	13	0	Ditto	Ditto	Ditto.
	4	8-A ...	2	1⅓	6	8	8	23	38	1	Ditto	Ditto	Ditto.
7 / 22	1	Type XI ...	2	1½	4	25	8	17	35	3	10th December 1919	3rd February 1920, 29th February 1920 and 28th March 1920.	Germination good, crop fair.
	2	8-A ...	2	1½	3	25	8	14	0	15	Ditto	Ditto	Germination good, but attacked by white ants.
	3	Type XI ...	2	1½	4	2	0	15	24	7	Ditto	Ditto	Germination good, crop fair.
	4	8-A ...	2	1⅓	3	25	0	14	12	13	Ditto	Ditto	Germination good, but attacked by white ants
11 / 7	1	Type XI ..	1	19¼	3	0	8	12	11	3	25th November 1919	31st January 1920, 24th February 1920 and 7th April 1920.	Germination good, Crop fair.
	2	8-A ...	1	19¼	4	4	0	16	28	8	Ditto	Ditto	Ditto.
	3	Type XI ...	1	19¼	4	14	0	17	29	4	Ditto	Ditto	Ditto.
	4	8-A ...	1	19¼	4	27	0	19	2	4	Ditto	Ditto	Ditto.
		Average yield per acre—									Average yield per acre calculated on yield per acre.		
	1	Type XI ...	12	4½	30	32	8	20	6	8	1 Type XI	Mds. 20	Srs. 2 Chtks. 12⅔
	2	8-A ...	12	3½	29	39	0	19	27	13	2 8-A	19	25 10

Statement No. 44.

COMPARATIVE VARIETAL TESTS OF LATE SOWN WHEATS (TYPE XI AND 8-A) ON LIGHT LAND WITH TWO IRRIGATIONS, GROWN IN TENANTS' AREA, DURING RABI, 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area.		Actual outturn.			Outturn per acre.			Date of sowing.	Dates of irrigations.	Remarks
			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
7 / 6	1	Type XI ...	2	2½	4	22	0	17	5	$2\frac{14}{17}$	10th December 1919.	3rd February 1920 and 11th March 1920.	Germination good, crop fair.
	2	8-A ...	2	2½	4	0	0	15	2	$\frac{14}{17}$	Ditto	Ditto	Ditto.
	3	Type XI ...	2	2½	4	35	0	18	14	$1\frac{14}{17}$	Ditto	Ditto	Ditto.
	4	8-A ...	2	2½	4	34	8	18	12	$1\frac{13}{17}$	Ditto	Ditto	Ditto.
20 / 3	1	Type XI ...	1	19	5	3	8	20	34	$3\frac{34}{39}$	29th November 1919.	1st February 1920 and 8th March 1920.	Germination good, crop good except few marlas.
	2	8-A ...	1	19	5	0	0	20	20	$\frac{20}{39}$	Ditto	Ditto	Ditto.
	3	Type XI ...	1	19	6	35	8	28	10	$4\frac{10}{39}$	Ditto	Ditto	Ditto.
	4	8-A ...	1	18	5	15	0	22	25	$4\frac{25}{39}$	Ditto	Ditto	Ditto.
20 / 6	1	Type XI ...	2	3	6	35	8	25	15	$6\frac{15}{43}$	28th November 1919	31st January 1920 and 6th March 1920.	Germination good, crop good.
	2	8-A ...	2	3	7	21	0	28	0	0	Ditto	Ditto	Ditto.
	3	Type XI ...	2	3	7	32	0	29	0	$14\frac{30}{43}$	Ditto	Ditto	Ditto.
	4	8-A ...	2	3	7	14	8	27	15	$13\frac{1}{43}$	Ditto	Ditto	Ditto.
		Average yield per acre—									Average yield per acre calculated on yield per acre.		
	1	Type XI ...	12	8½	36	3	8	23	9	6	1 Type XI	Mds. 23	Srs. Chtks. 6 8½
	2	8-A ...	12	7½	34	5	0	22	2	7	2 8-A	21	39 6

Statement No. 45.

COMPARATIVE VARIETAL TESTS OF WHEATS (TYPES 17 AND 8-A) GROWN IN TENANTS' AREA DURING RABI 1919-20.

No. of square and plot.	No. of Sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Dates of irrigations.	Date of sowing.	Remarks.
7/14	1	Type 17 ...	2	1	6	18	0	25	6	13	11th December 1919, 28th February 1920 and 27th March 1920.	3rd November 1919.	Germination good, crop good.
	2	8-A ...	2	1	6	32	0	26	21	7	Ditto	Ditto	Ditto.
	3	Type 17 ...	2	1	6	18	8	25	8	12	Ditto	Ditto	Ditto.
	4	8-A ...	2	1	7	27	0	29	38	1	Ditto	Ditto	Ditto.
13/9	1	Type 17 ...	2	5½	6	25	8	23	13	10	14th December 1919, 23rd February 1920 and 18th March 1920.	14th November 1919.	Germination good, crop fairly good.
	2	8-A ...	2	5½	7	1	0	24	28		Ditto	Ditto	Ditto.
	3	Type 17 ...	2	5½	6	25	0	23	11	13	Ditto	Ditto	Ditto.
	4	8-A ...	2	5½	7	22	0	26	21	14	Ditto	Ditto	Ditto.
16/11	1	Type 17 ...	2	4⅜	6	15	8	22	33	8	31st January 1920, 6th March 1920 and 7th April 1920.	2nd December 1919.	Germination good, crop good.
	2	8-A ...	2	4¾	5	28	0	20	15	3	Ditto	Ditto	Ditto.
	3	Type 17 ...	2	4⅜	7	24	8	27	8	11	Ditto	Ditto	Ditto.
	4	8-A ...	2	4⅜	8	22	0	30	22	12	Ditto	Ditto	Ditto.
16/11	1	Type 17 ...	2	0	4	39	0	19	36	0	31st January 1920, 6th March 1920 and 7th April 1920.	30th November 1919.	Germination good, crop good.
	2	8 A ...	2	0	4	7	8	16	10	0	Ditto	Ditto	Ditto.
	3	Type 17 ...	2	0	4	34	8	19	18	0	Ditto	Ditto	Ditto.
	4	8-A ...	2	0	3	36	0	15	24	0	Ditto	Ditto	Ditto.
Average yield per acre—													
	1	Type 17 ...	17	2½	51	0	8	23	14	8			
	2	8-A ...	17	2½	51	15	8	24	0	3			

Average yield per acre calculated on yield per acre

	Mds.	Srs.	Chtks.
1 Type 17	23	12	2
2 8-A	23	35	3

Statement No. 46.

COMPARATIVE VARIETAL TESTS OF WHEATS (TYPES 11 AND MR. HOWARDS' N. H_4 AND P—3), GROWN IN TENANTS' AREA, DURING RABI 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Dates of irrigations.	Date of sowing.	Remarks.
16/8	1	Type 11 ...	2	6¾	4	24	0	15	29	11	14th December 1919, 12th February 1920 and 6th April 1920.	11th November 1919.	Germination good, crop good.
	2	N H_4 + P_6.	2	6¾	4	2	0	13	34	7	Ditto	Ditto	Ditto.
	3	Type 11 ...	2	6¾	5	5	8	17	23	5	Ditto	Ditto	Ditto.
	4	N H_4 + P_6.	2	6¾	4	36	0	16	30	12	Ditto	Ditto	Ditto.
Average yield per acre—													
	1	Type 11 ...	4	13½	9	29	8	16	26	8			
	2	N H_4 + P_6.	4	13½	8	38	0	15	12	9			

Average yield per acre calculated on yield per acre.

	Mds.	Srs.	Chtks.
1 Type 11	16	26	8
2 N H_4 + P_6.	15	12	9½

Statement No. 47.

SHOWING THE COMPARATIVE TESTS OF BARLEYS (E. B.'s Nos. 1, 2 AND 5 AGAINST LOCAL) AT L. A. S. DURING RABI, 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Previous crops.	Dates of waterings.	Remarks.
26 B	1	Local barley ...	1/8th of an acre.	3	18	14	2	26	2	27	31	0	21	9	0	Guara sown on 19th June 1919. Ploughed in as green manure on 18th-20th September 1919 by Ransome's E. C. Plough crops was uneven in the several plots.	31st January 1920, and 5th March 1920.	Land uneven and not of uniform quality. Moreover the green manuring crop of guara also very uneven; hence value of figures rather unreliable.
	2	E. B. No. 5 ...		2	26	14	4	28	2	21	15	0	37	25	0			
	3	E. B. No. 5 ...		3	16	4	4	19	12	27	10	0	35	38	0			
	4	Local barley ...		2	8	10	6	9	6	17	29	0	49	35	0			
	5	Local barley ...		1	29	10	6	5	6	13	37	0	49	3	0			
	6	E. B. No. 2 ...		2	39	0	5	5	0	23	32	0	41	0	0			
	7	Local ...		2	36	15	5	24	1	23	15	8	44	32	8			Ploughing—1.
	8	E. B. No. 2 ..		3	10	2	5	1	14	26	1	0	40	15	0			Sohagings—3.
	9	Local ...		3	2	7	4	12	9	24	19	8	34	20	8			Harrowing—1.
	10	E. B. No. 1 ...		2	5	3	5	29	13	17	1	8	45	38	8			Surface harrowings—1 and weedings—2.
	11	Local ...		2	36	8	4	34	8	23	12	0	38	36	0			Date of sowing—9th November 1919.
	12	E. B. No. 1 ...		2	15	8	5	19	8	19	4	0	43	36	0			Date of harvesting—13th-17th April 1920.
		Average yield per acre—																
		Local barley ...	...	...	...	...	...	...	...	21	30	10⅔	39	29	5⅓			
		E. B. No. 5 ...	...	...	...	...	...	...	...	24	12	8	36	31	8			
		E. B. No. 2 ...	...	...	..	...	...	...	...	24	36	8	40	27	8			
		E. B. No. 1 ...	...	...	..	...	...	...	...	18	2	12	44	37	4			

Statement No. 48.

COMPARATIVE RESULTS OF GRAMS, LOCAL AND E. B. No. 7, GROWN IN TENANTS' AREA DURING RABI, 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grams. Maunds.	Seers.	Chataks.	Outturn of grain per acre. Maunds.	Seers.	Chataks.	Dates of irrigations.	Date of sowing.	Remarks.
19 1	1	Local ...	1	8	5	4	8	29	8	9	7th March 1920.	21st October 1919.	Germination good, crop good.
	2	E. B.'s No. 7.	1	8	5	23	8	31	37	2	Ditto	Ditto	Ditto.
	3	Local ...	1	8	5	30	0	32	34	2	Ditto	Ditto	Ditto.
	4	E. B.'s. No. 7	1	8	4	29	0	27	0	0	Ditto	Ditto	Germination good crop though regular in germination but comparatively poor than the adjoining strip on account of the land being poor here.
6 1 4	1	Local ...	2	4½	4	11	4	15	15	12	29th February 1920.	18th October 1919	Germination good, crop fair.
	2	E. B.'s No. 7.	2	4½	4	36	0	17	24	12	Ditto	Ditto	Ditto.
	3	Local ...	2	4½	4	15	0	15	29	3	Ditto	Ditto	Ditto.
	4	E. B.'s No. 7.	2	4½	4	31	0	17	6	12	Ditto	Ditto	Ditto.
		Average yield per acre—										Average yield per acre calculated on yield per acre. Mds. Srs. Chs.	
	1	Local ...	7	5	19	20	8	21	21	4		1 Local ...	23 11 14
	2	E. B.'s No. 7	7	5	19	39	8	22	2	3		2 E.B.'s No. 7 ...	23 17 2

Statement No. 49.

COMPARATIVE RESULTS OF GRAMS (LOCAL AND E. B.'S No. 17), GROWN IN TENANTS' AREA DURING RABI 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of Grain. Maunds.	Actual outturn of Grain. Seers.	Actual outturn of Grain. Chataks.	Outturn of Grain per acre. Maunds.	Outturn of Grain per acre. Seers.	Outturn of Grain per acre. Chataks.	Dates of irrigation.	Date of sowing.	Remarks.
16	1	Local ...	2	1½	5	27	8	22	2	7	6th March 1920 ...	18th October 1919 ...	Germination good. Stand good.
22	2	E. B.'S No. 17 ...	2	1½	6	2	8	23	20	10	Ditto ...	Ditto ...	Ditto ditto.
	3	Local ...	2	1½	6	1	0	23	14	13	Ditto ...	Ditto ...	Ditto ditto.
	4	E. B.'S No. 17 ...	2	0	6	5	0	24	20	0	Ditto ...	Ditto ...	Ditto ditto.
		AVERAGE YIELD PER ACRE—										AVERAGE YIELD PER ACRE CALCULATED ON YIELD PER ACRE. Mds. s. c.	
	1	Local ...	4	2½	11	28	8	22	28	9	...	1 Local ...	22 28 10
	2	E. B.'S No. 17 ...	4	1½	12	7	8	23	39	0	...	2 E. B.'s No. 17	24 0 5

Statement No. 50.

COMPARATIVE RESULTS OF GRAMS (LOCAL AND E. B.'S No. 15), GROWN IN TENANTS' AREA DURING RABI, 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of Gram. Maunds.	Actual outturn of Gram. Seers.	Actual outturn of Gram. Chataks.	Outturn of Gram per acre. Maunds.	Outturn of Gram per acre. Seers.	Outturn of Gram per acre. Chataks.	Date of sowing.	Date of irrigation.	Remarks.
19	1	Local	1	12	4	5	0	20	25	0	18th October 1919 ...	29th February 1920	Germination good. Suffered a bit through treading of people.
13	2	E. B.'S No. 15 ...	1	15	4	33	0	22	2	5	Ditto ...	Ditto ...	Germination good. Stand good.
	3	Local ...	1	15	4	37	0	22	20	9	Ditto ...	Ditto ...	Ditto ditto.
	4	E. B.'S No. 15 ...	1	15	5	11	0	24	4	9	Ditto ...	Ditto ...	Ditto ditto.
		AVERAGE YIELD PER ACRE—										AVERAGE YIELD PER ACRE CALCULATED ON YIELD PER ACRE. Mds. s. c.	
	1	Local ...	3	7	9	2	0	21	24	7	...	1 Local ...	21 22 12
	2	E. B.'S No. 15 ...	3	10	10	4	0	23	3	7	...	2 E. B's No. 15	23 3 7

Statement No. 51.

COMPARATIVE RESULTS OF GRAMS (LOCAL AND E. B.'S No. 20), GROWN IN TENANTS' AREA DURING RABI 1919-20.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of Gram. Maunds.	Actual outturn of Gram. Seers.	Actual outturn of Gram. Chataks.	Outturn of Gram per acre. Maunds.	Outturn of Gram per acre. Seers.	Outturn of Gram per acre. Chataks.	Date of irrigation.	Date of sowing.	Remarks.
17	1	Local ...	2	1½	7	20	0	29	3	10	8th March 1920 ...	18th October 1919 ...	Germination good. Crop good.
21	2	E. B.'S No. 20 ...	2	1½	7	36	0	30	25	11	Ditto ...	Ditto ...	Germination good. Crop good except about 3 marlas, where there was Kallar.
	3	Local ...	2	1½	8	11	0	32	3	14	Ditto ...	Ditto ...	Germination good. Crop good.
	4	E. B.'S No. 20 ...	2	1½	8	22	0	33	6	9	Ditto ...	Ditto ...	Ditto ditto.
		AVERAGE YIELD PER ACRE—										AVERAGE YIELD PER ACRE CALCULATED ON YIELD PER ACRE. Mds. s. c.	
	1	Local ...	4	2½	15	31	0	30	23	12	...	1 Local ...	30 23 12
	2	E. B.'S No. 20 ...	4	2½	16	18	0	31	36	2	...	2 E. B's No. 20...	31 36 2

Statement No. 52.

SHOWING THE COMPARATIVE RESULTS OF 4-F. AND 285-F. WITH FREQUENT WATERINGS, GROWN BY TENANTS AT L. A.S., DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	No of hoeings with dates.	Irrigations with dates.	Previous crop.	Remarks.
3 / 24	1	4-F ...	1	19	Medium loam	1	0	4	4	6	15	Eight on— 8th April 1919.	Nine on— 9th June 1919. 21st June 1919.	Senji	Germination regular. Stand good.
	2	285-F	1	19	Ditto ...	1	8	4	4	37	15	21st April 1919. 4th May 1919.	8th July 1919. 22nd July 1919.	Do.	Ditto.
	3	4-F ...	1	19	Ditto ...	1	18	0	5	37	15	11th May 1919. 11th June 1919. Ditto. 24th June 1919.	4th September 1919. 19th September 1919. 1st October 1919 12th October 1919.	Do.	Ditto.
	4	285-F	1	19	Ditto ...	1	19	10	6	4	9	12th July 1919.	6th November 1919.	Do.	Ditto.
5 / 10	1	4-F ...	2	4	Medium loam	1	21	0	5	21	13	Six on— 8th April 1919.	Seven on— 16th June 1919.	Do.	Germination good. Stand good.
	2	285-F	2	4	Ditto ...	2	0	3	7	11	9	9th May 1919. 19th June 1919.	3rd July 1919. 11th August 1919.	Do.	Ditto.
	3	4-F ...	2	4	Ditto ...	1	29	14	6	14	1	21st June 1919. 8th July 1919 8th August 1919.	11th September 1919 25th September 1919. 8th October 1919. 3rd November 1919.	Do.	Ditto.
	4	285-F	2	4	Ditto ...	1	25	14	5	39	9			Do.	Germination good but a few plants died in May.
17 / 7	1	4-F ...	2	2	Heavy loam ...	1	14	14	5	9	1	Seven on— 11th April 1919.	Seven on— 27th May 1919.	Do.	Germination fair. Stand fair.
	2	285-F	2	3	Ditto ...	1	18	8	5	17	11	1st May 1919. 9th May 1919.	15th June 1919. 7th July 1919.	Do.	Ditto.
	3	4-F ...	2	3	Ditto ...	1	23	12	5	37	3	30th May 1919. 19th June 1919. 11th July 1919.	21st July 1919. 2nd September 1919. 24th September 1919.	Do.	Ditto.
	4	285-F	2	2	Ditto ...	1	11	2	4	34	12	27th July 1919.	11th October 1919.	Do.	Germination irregular. Stand poor to fair.
20 / 5	1	4-F ...	1	16	Heavy to medium loam.	1	12	10	5	33	14	Eight on— 10th April 1919.	Eight on— 26th May 1919.	Do.	Germination good. Stand good. Land good.
	2	285-F	1	16	Ditto ...	1	7	4	5	10	0	3rd May 1919. 7th May 1919.	27th June 1919. 8th July 1919.	Do.	Germination good. Stand good.
	3	4-F ...	1	16	Ditto ...	1	1	5	4	23	10	29th May 1919. 30th May 1919. 2nd July 1919	22nd July 1919. 3rd September 1919. 26th September 1919.	Do.	Land getting poorer from Nos. 1 to 2 and 2 to 3 gradually.
	4	285-F	1	16	Ditto ..	0	35	15	3	39	12	12th July 1919. 17th July 1919.	6th October 1919. 13th October 1919.	Do.	Poor land. Stand poor in about $\frac{1}{15}$ area.
13 / 16	1	4-F ...	1	18	Heavy loam ...	0	38	4	4	1	1	Five on— 13th May 1919.	Six on— 3rd June 1919.	Wheat	Germination fairly good. Stand good. Except $\frac{1}{15}$ area; land getting poorer from strips Nos. 1 to 4.
	2	285 F	1	18	Ditto ..	1	8	2	5	2	10	6th June 1919. 7th July 1919. Ditto.	3rd July 1919. 17th August 1919. 6th September 1919.	Do.	
	3	4-F ...	1	18	Ditto ...	0	31	12	3	13	11	11th August 1919.	25th September 1919. 6th October 1919.	Do.	Ditto.
	4	285-F	1	18	Ditto ...	0	31	7	3	12	4			Do.	Ditto.
16 / 18	1	4-F ...	2	5	Heavy loam ...	2	6	6	7	27	2	Four on— 25th April 1919.	Six on— 2nd July 1919.	Do.	Germination good. Stand very good.
	2	285-F	2	4	Ditto ...	2	6	5	7	33	14	6th July 1916. 9th July 1919.	16th July 1919. 18th August 1919.	Do.	Ditto.
	3	4-F ...	2	4½	Ditto ...	1	39	9	7	6	2	11th August 1919.	12th September 1919. 25th September 1919. 7th October 1919.	Do.	Ditto.
	4	285-F	2	2	Ditto	1	32	15	6	37	14			Do.	Stand rather thin.
17 / 18	1	4-F ...	2	1½	Heavy loam ...	0	23	0	2	8	11	Five on— 2nd June 1919.	Six on— 15th June 1919.	Do.	Germination good throughout. Stand good.
	2	285-F	2	1	Ditto ...	1	3	4	4	8	12	19th June 1919. 2nd July 1919.	28th June 1919. 14th July 1919.	Do.	Ditto.
	3	4-F ...	2	1½	Ditto ...	0	27	11	2	26	12	18th July 1919. 16th August 1919.	2nd September 1919. 25th September 1919. 12th October 1919.	Do.	Ditto.
	4	285-F	1	19	Ditto ...	1	12	12	5	16	6			Do.	Ditto.

Average yield per acre.

												Average yield per acre calculated on yield per acre.
												Mds. s. c.
1	4-F ...	28	11½	...	18	8	12	5	3	15		5 1 15½
2	285-F	28	5	...	19	21	9	5	21	5		5 19 2

Statement No. 53.

SHOWING THE COMPARATIVE RESULTS OF 4-F AND 285-F WITH LESS NUMBER OF WATERINGS, GROWN BY TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	No. of hoeings with dates.	Irrigations with dates.	Previous crop.	Remarks.
3 / 25	1	4-F ...	1	8	Medium loam	0	20	9	2	37	8	Five on— 14th April 1919. 7th May 1919. 14th May 1919. 24th June 1919. 26th July 1919.	Five on— 21st June 1919. 22nd July 1919. 19th September 1919. 12th October 1919. 6th November 1919.	Senji	Germination fairly good. Stand fair.
	2	285-F ...	1	8	Ditto ..	0	23	1	3	11	12			Do.	Ditto.
	3	4-F ...	1	8	Ditto ..	0	15	12	2	10	0			Do.	Ditto.
	4	285-F ...	1	7	Ditto ...	0	16	2	2	15	9			Do.	Germination fairly good. Land poor here.
6 / 15	1	4-F ...	1	18	Ditto ...	0	27	6	2	35	4	Five on— 12th April 1919. 6th May 1919. 10th May 1919. 2nd July 1919. 3rd August 1919.	Four on— 30th June 1919. 4th September 1919. 28th September 1919. 11th October 1919.	Do.	Germination good. Stand very good.
	2	285-F ...	1	18	Ditto ...	1	10	8	5	12	10			Do.	Ditto.
	3	4-F ...	1	18	Ditto ...	0	34	13	3	26	9			Do.	Ditto.
	4	285-F ...	1	18	Ditto	1	21	10	6	19	8			Do.	Ditto.
20 / 4	1	4-F ...	1	18	Medium to heavy loam.	0	27	8	2	35	12	Five on— 14th April 1919. 9th May 1919. 18th June 1919. 17th July 1919. 27th July 1919.	Four on— 15th June 1919. 13th July 1919. 18th September 1919. 11th October 1919.	Do.	Germination good. Stand good. Land getting poorer from 1 to 4.
	2	285-F ...	1	18	Ditto	1	1	4	4	13	11			Do.	Ditto.
	3	4-F ...	1	18	Ditto	0	26	0	2	11	13			Do.	Ditto.
	4	285 F	1	18	Ditto	0	33	0	4	0	0			Do.	Ditto.
16 / 20	1	4-F	2	3	Heavy loam ...	0	39	10	3	25	2	Seven on— 14th April 1919. 29th April 1919. 10th May 1919. 18th June 1919. 19th July 1919. 23rd July 1919. 10th August 1919.	Five on— 15th June 1919. 16th July 1919. 18th August 1919. 25th September 1919. 19th October 1919.	Do.	Germination rather thin. Stand good.
	2	285-F ...	2	1½	Ditto ...	1	0	11	3	36	13			Do.	Ditto.
	3	4 F ...	2	3	Ditto ...	0	28	6	2	25	9			Do.	Ditto.
	4	285-F ...	2	2	Ditto ..	0	39	7	3	30	4			Do.	Ditto.
13 / 11	1	4-F ..	1	19	Heavy loam rather kalrathi.	0	25	7	2	24	5	Three on— 6th July 1919. Ditto. 10th August 1919.	Four on— 3rd July 1919. 30th August 1919. 25th September 1919. 13th October 1919.	Wheat	Germination good. Stand good.
	2	285-F ...	1	19	Ditto	1	4	15	4	22	5			Do.	Ditto.
	3	4-F ...	1	18½	Ditto	0	24	15	2	23	10			Do.	Ditto.
	4	285-F ...	1	18½	Ditto	0	35	14	3	29	1			Do.	Ditto.
17 / 24	1	4-F ...	1	18	Heavy loam ...	0	31	5	3	11	13	Four on— 2nd June 1919. 2nd July 1919. 27th July 1919. 10th August 1919.	Three on— 27th June 1919. 21st July 1919. 26th September 1919.	Do.	Ditto.
	2	285-F ...	1	17½	Ditto ...	1	8	12	5	8	0			Do.	Ditto.
	3	4-F ...	1	17½	Ditto ...	0	35	9	3	18	6			Do.	Ditto.
	4	285-F ...	1	18	Ditto ...	1	11	0	5	14	12			Do.	Ditto.
19 / 11	1	4-F ...	1	18	Ditto ...	1	10	5	5	11	13	Five on— 25th April 1919. 12th May 1919. 17th June 1919. 17th July 1919. 13th August 1919.	Four on— 15th June 1919. 13th July 1919. 3rd September 1919. 29th September 1919.	Do.	Ditto.
	2	285-F ...	1	18	Ditto ...	1	33	1	7	27	10			Do.	Ditto.
	3	4-F ...	1	18	Ditto ...	0	33	1	3	19	3			Do.	Land poor otherwise good.
	4	285-F ...	1	18	Ditto ...	1	15	8	5	33	11			Do.	Land fairly good. Stand good.

Average yield per acre—

												Average yield per acre calculated on yield per acre. Mds.	Srs.	Chtks.
	1	4-F ...	26	3	...	10	20	10	3	8	3	3	5	6
	2	285-F ...	25	19½	...	15	19	13	4	30	13	4	28	2

Statement No. 54.

SHOWING THE COMPARATIVE RESULTS OF G. I. MOLLISONI 24 AND FARM SELECTED BROAD LEAVED (SANGUINUM), GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF, 1919.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	No. of hoeings with dates.	No. of irrigations with dates.	Previous crops.	Remarks.
3 / 12	1	Mollisoni 24.	2	3	Sandy calcarious loam.	2	28	4	10	2	13	Three on- 9th April 1919. 4th May 1919. 13th May 1919.	Five on— 21st June 1919. 9th August 1919. 19th September 1919.	Toria	Germination good. Stand good. Land poor and sandy.
	2	F. S. B.* leaved.	2	3	Ditto	3	5	6½	11	26	10			Do.	Germination good. Stand good.
	3	Mollisoni 24.	2	3	Ditto	3	33	13	14	30	15		1st October 1919. 12th October 1919.	Do.	Ditto.
	4	F. S. B. leaved.	2	3	Ditto	3	3	14½	11	21	1			Do.	Ditto.
13 / 10	1	Mollisoni 24.	2	2½	Heavy loam ...	2	26	3	9	33	0	Seven on— 13th April 1919. 5th May 1919. Ditto. 13th May 1919. 18th June 1919. 25th July 1919. 9th August 1919.	Four on— 14th June 1919. 30th August 1919. 25th September 1919. 26th October 1919.	Gram	Germination good. Stand rather thin than the other strip No. 3.
	2	F. S. B. leaved.	2	2½	Ditto ...	2	31	3	10	18	9			Do.	Germination good. Stand good.
	3	Mollisoni 24.	2	2½	Ditto ...	3	4	8	11	28	11			Do.	Ditto.
	4	F. S. B. leaved.	2	3	Ditto ...	2	32	6	10	18	2			Do.	Ditto.
17 / 23	1	Mollisoni 24.	2	1	Ditto ...	5	2	12	19	31	3	Five on - 17th April 1919. 21st April 1919. 12th May 1919. 30th May 1919. 10th July 1919.	Five on— 27th May 1919. 7th July 1919. 12th September 1919. 30th September 1919. 12th October 1919.	Do.	Ditto.
	2	F. S. B. leaved.	2	1	Ditto ..	4	0	7	15	26	1			Do.	Ditto.
	3	Mollisoni 24.	2	1	Ditto ...	4	18	3	17	15	6			Do.	Ditto.
	4	F. S. B. leaved.	2	1	Ditto ...	3	30	10	12	29	12			Do.	Ditto.
19 / 9	1	Mollisoni 24.	1	15	Ditto ...	3	9	8	14	32	0	Five on— 17th April 1919. 21st April 1919. 14th May 1919. 10th June 1919. 12th July 1919.	Six on— 7th June 1919. 8th July 1919. 13th August 1919. 11th September 1919. 29th September 1919. 13-20th September 1919.	Toria and Senji.	Germination fairly good. Stand very fair to good
	2	F. S. B. leaved.	1	15	Ditto ...	2	35	12	13	7	11			Do.	Ditto.
	3	Mollisoni 24.	1	16	Ditto ...	3	18	0	15	30	13			Do.	Ditto.
	4	F. S. B. leaved.	1	15	Ditto ..	3	1	10	13	36	0			Do.	Ditto.
7 / 23	1	Mollisoni 24.	2	2	Calcarious loam	3	3	9	11	30	11	Five on— 7th May 1919. 15th May 1919. 10th June 1919. 26th July 1919. 10th August 1919.	Five on— 2nd June 1919. 21st July 1919. 17-19th September 1919. 30th September 1919. 11th October 1919.	Wheat	Germination fairly good. Stand fair.
	2	F. S. B. leaved.	2	2	Ditto ..	2	24	10	9	33	9			Do.	Ditto.
	3	Mollisoni 24.	2	2	Ditto ...	2	9	4	8	20	0			Do.	Ditto.
	4	F. S. B. leaved	2	2	Ditto ...	2	20	6	9	22	6			Do.	Ditto.
10 / 3	1	Mollisoni 24.	1	19	Ditto ..	2	37	9	12	2	5	Seven on— 7th May 1919. 19th May 1919. 30th May 1919. 1st June 1919. 20th June 1919. 10th July 1919. 2nd August 1919	Four on— 28th May 1919. 7th July 1919. 13th September 1919. 7th October 1919.	Do.	Germination fairly good. Stand very fair.
	2	F. S. B. leaved.	1	19	Ditto ...	3	8	11	13	8	4			Do.	Ditto.
	3	Mollisoni 24.	1	19	Ditto ...	3	7	12	13	4	1			Do.	Ditto.
	4	F S. B. leaved.	1	19	Ditto ...	3	2	3	12	21	4			Do.	Ditto.

												Average yield per acre calculated on yield per acre. Mds.	Srs.	Chtks.	
Average yield per acre—	1	Mollisoni 24.	24	5	...	40	4	5	13	9	3	13	12	3	Difference in favour of Mollisoni is more on good land.
	2	F. S. B. leaved.	24	5½	...	36	37	3	12	6	12	12	3	0	

*F. S. B.=Farm selected broad-leaved.

Statement No. 55.

SHOWING THE COMPARATIVE RESULTS OF GOSSYPIUM INDICUM MOLLISONI 24 AND K-22 OF MR. LEAK OF CAWNPUR, GROWN WITH TENANTS AT THE LYALLPUR AGRICULTURAL STATION DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	No of hoeings with dates.	Irrigations with dates.	Previous crop.	Remarks.
16 23	1	Mollisoni 24...	2	4	Medium Loam	4	0	10	14	24	1	Six on— 18th April 1919. 29th April 1919. 12th May 1919. 29th May 1919. 7th July 1919. 12th August 1919.	Five on— 26th May 1919. 3rd July 1919, 30th August 1919. 27th-30th September 1919. 19th October 1919.	Toria	Germination good Stand good.
	2	K-22 ..	2	4	Ditto	1	11	0	4	25	7			Do.	Ditto.
	3	Mollisoni 24...	2	4	Ditto	3	14	6	12	8	11			Do.	Ditto.
	4	K-22 ...	2	4	Ditto	1	7	2	4	11	6			Do.	Ditto.
		Average yield per acre—										Average yield per acre calculated on yield per acre.			
	1	Mollisoni 24...	4	8	...	7	15	0	13	16	6	Mds. Srs. Chtks. 13 16 6			
	2	K-22 ...	4	8	...	2	18	2	4	18	6	4 18 6			

Statement No. 56.

SHOWING THE COMPARATIVE RESULTS OF 4-F AND RISALA AMERICAN GROWN WITH TENANTS AT THE LYALLPUR AGRICULTURAL STATION DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	No. of hoeings with dates	Irrigations with dates.	Previous crop.	Remarks.
6 2	1	4-F. ...	2	3	Calcarious Loam.	0	15	11	1	18	6	Five on— 10th May 1919. 12th June 1919 25th July 1919. 2nd August 1919. 13th August 1919.	Five on— 8th June 1919. 22nd July 1919. 9th August 1919. 13th September 1919. 11th October 1919.	Grams	Germination good. Stand good.
	2	Risala ...	2	3	Ditto	0	16	3	1	20	4			Do.	Ditto.
	3	4-F. ...	2	3	Ditto	0	17	1	1	23	8			Do.	Ditto.
	4	Risala ...	2	3	Ditto	0	20	3	1	35	2			Do.	Ditto.
		Average yield per acre—										Average yield per acre calculated on yield per acre.			
	1	4-F. ...	4	6	...	0	32	12	1	20	15	Mds. Srs Chtks. 1 20 15			
	2	Risala ...	4	6	...	0	36	6	1	27	11	1 27 11			

Statement No. 57.

SHOWING THE COMPARATIVE RESULTS OF 4-F. AND 4-F. SELECTIONS NO. 1 AND SELECTION WITH YELLOW COLOURED COROLLA, GROWN WITH TENANTS AT THE LYALLPUR AGRICULTURAL STATION DURING KHARIF 1919.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Srs.	Outturn per acre. Chtaks.	No. of hoeings with dates.	Irrigation with dates.	Previous crop.	Remarks.
13 6	1	4-F. ...	2	3	Heavy loam	1	15	10	5	7	0	Six on— 15th April 1919. 7th May 1919. 7th June 1919. 8th July 1919. 18th July 1919. 11th August 1919.	Six on— 3rd June 1919. 3rd July 1919. 17th August 1919. 12th September 1919 5th September 1919 20th October 1919.	Toria.	Germination good. Stand good.
	2	4-F. Selection No. 1	2	3	Ditto	1	16	12	5	11	3			Do.	Ditto.
	3	4-F. ...	2	3	Ditto	1	8	10	4	7	0			Do.	Ditto.
	4	American Selection with yellow Corolla.	2	3	Ditto	1	11	14	4	32	9			Do.	Ditto.
		Average yield per acre—										Average yield per acre calculated on yield per acre.			
	1	4-F. ...	4	6	...	2	24	4	4	33	15	Mds. Srs. Chtks. 4 27 0			
	2	4-F. Selection No. 1.	2	3	...	1	16	12	5	11	3	5 11 3			
	3	American Selection with yellow corolla.	2	3	...	1	11	14	4	32	9	4 32 9			

Statement No. 58.

SHOWING THE OUTTURNS OF THE AMERICAN AND DESI COTTONS SELECTIONS GROWN IN KHARIF 1919 AT LYALLPUR AGRICULTURAL STATION.

Square and plot.	Dimensions of plot.	Area in square yards.	Name of variety.	Date of sowing.	Date of first picking.	Date of last picking.	Actual outturn. Sers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Length of lint in inches.	Per cent. of lint to cotton. 1919.	Per cent. of lint to cotton. 1918.	Per cent. of lint to cotton. 1917.	Remarks.
27/B2	100×4	400/9	Desi Selection No. 21/1	24th April 1919.	4th November 1919.	4th February 1920.	7	0	19	2 1/16	·6″	31·5	32·55	32·6	Germination and stand good.
	100×6	600/9	Hortuilla No. 11				0	12	1	14 7/16	1·2″	30·6	31·87	33·6	Germination good and stand poor plants died of heat.
	100×4	400/9	Desi Selection No. 23/3				11	6	30	38 10/16	·7″	31·8	33·33	33·33	Germination and stand good.
	100×6	600/9	Kenan Goodson				0	7	0	31 7/16	1·1″	30·9	31·25	31·9	Germination good and stand poor; plants died of heat.
	100×4	400/9	Desi Selection No. 24/2				10	8	28	23 13/16	·7″	33·3	34·7	34·7	Germination and stand good.
	100×6	600/9	Mexican Big Boll				0	10	1	5 6/16	1·0″	30·8	32·3	32·5	Germination good; plants died of heat; stand poor.
	100×4	400/9	Desi Selection No. 24/7				7	4	19	29 9/16	·7″	35·4	38·0	38·4	Germination and stand good.
	100×6	600/9	Webeer No. 49				0	5	0	22 11/16	1·2″ 1·3″	30·3	30·5	31·2	Germination good; plants died of heat; stand poor.
	100×4	400/9	Desi Selection No. 25/6				13	12	37	17 6/16	·6″	34·6	36·3	38·8	Germination and stand good.
	100×6	600/9	4-F. No. 1				4	14	8	33 14/16	1·0″	32·5	32·6	32·7	Germination and stand good; suffered from dry season.
	100×4	400/9	Desi Selection No. 208/3				13	8	36	30 2/16	·6″	36·2	38·7	40·0	Germination and stand good.
	100×6	600/9	4-F. No. 2				5	2	9	12 1/16	1·0′	32·1	33 3	32·4	Germination and stand good; suffered from dry season.
	100×4	400/9	Desi No. 208/7				14	10	39	32 11/16	·7″	35·2	36·1	37·5	Germination and stand good.
	100×6	600/9	4-F. No. 5				5	6	9	30 3/16	1·0″	32·0	32·2	33·3	Germination and stand good; suffered from dry season.
	100×4	400/9	Desi Cross No. 18				13	6	36	16 3/16	·6″	33·0	33·3	33·0	Germination and stand good.
	100×6	600/9	Ata Mohds., Special No. 1				6	0	10	35 10/16	1·2″	31·9	31·8	31·9	Germination and stand good; suffered from dry season.
	100×4	400/9	Desi Cross No. 5				13	6	36	16 3/16	·6″	32·1	33·0	32·3	Germination and stand good.
	95×6	570/9	Ata Mohds., Special No. 2				7	1	14	32 4/16	1·2″	31·8	31·9	32·0	Germination and stand good; suffered from dry season.
	88×4	352/9	Mollisoni No. 24				12	8	38	26 14/16	·6″	37·9	38·0	...	Germination and stand good.
	85×6	510/9	American Selection with yellow Corolla.				7	2	14	25 0/16	·9″ to 1·0	31·20	31·0 c	25·53	Germination and stand good; suffered from dry season.
	85×4	340/9	Mollisoni No. 24				9	8	30	17 3/16	·6″	37·9	38·0	...	Germination and stand good.

Statement No. 59.

ROW TO ROW TEST OF 4-F AND 285-F AMERICAN COTTONS GROWN IN SQUARE 29—KHARIF 1919.

No. of line.	Treatment.	Field of each line.				No. of irrigations with dates.	Remarks.
		4-F.		285-F.			
		Seers.	Chataks.	Seers.	Chataks.		
1	Ordinary cultivation ...	8	8	5	7½	17th June 1919, 9th July 1919, 17th July 1919 and 26th September 1919.	
2	...	6	1	4	6		
3	Each variety sown furrow by furrow at 3′ apart.	4	12	4	6		
4	...	4	1	4	14½		
5	...	3	0	4	13		
6	...	3	8	5	4		
7	...	3	2½	4	5		
8	...	2	3	4	11½		
9	...	2	2½	4	15		
10	...	2	14½	5	2½		
11	...	3	½	4	1½		
12	...	2	14	4	3½		
13	...	2	8	4	3½		
14	...	2	10½	4	11½		
15	...	2	14½	4	9		
16	...	3	0	4	5½		
17	...	3	0	3	12		
18	...	3	2	4	6		
19	...	3	5	6	10		

Total area under each variety.

Kanals.	Marlas.
4	4·9

Total yields.

Mds.	Srs.	Chts.	Mds	Srs.	Chts.
1	26	10	2	10	½

Yields per acre

Mds.	Srs.	Chts.	Mds.	Srs.	Chts.
3	5	9	4	9	11

Cultivation.

Ploughings Raja	...	...	... 1
Sohagings	...	...	... 3
Horse hoes	...	...	... 2
Hoeings { Horse hoes	...	...	... 2
Hoeings { Drill harrows	..	...	... 2

Date of sowing—28th April 1919.
Picking began on 30th October 1919.
" finished on 24th November 1919.

Statement No. 60.

STATEMENT SHOWING THE OUTTURN OF MANGEL WURZEL GROWN SQUARE 26, AREA D, DURING RABI 1919-20.

No. of square and plot.	Manure.	Area in acres.	Treatment.	Actual outturn.				Outturn per acre.				Dates of irrigations.	Dates of harvesting.	Remarks.
				Roots		Leaves.		Roots.		Leaves.				
				Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.			
26 / 1 / D	Farm yard manure at 15 tons per acre and top dressing of ashes at 18 tons per acre.	99 / 960	Frequent waterings	70	11	29	24	681	18	287	1	4th November 1919, 9th December 1919, 2nd February 1920, 22nd February 1920, 4th March 1920, 16th March 1920, 31st March 1920 and 10th April 1920.	21st April 1920 to 23rd April 1920.	Difference in favour of more frequently-watered plots was more obvious in the early stages of growth. In the last stages it became less apparent.
26 / 2 / D		99 / 960	Not frequent waterings.	69	6	22	33	670	21	222	21	4th November 1919, 9th December 1919, 2nd February 1920, 4th March 1920 and 31st March 1920.	24th April 1920 to 28th April 1920.	
26 / 3 / D		99 / 960	Frequent waterings.	73	3	20	29	708	24	200	38	As in plot No. 1.	28th April 1920 to 5th May 1920.	
26 / 4 / D		99 / 960	Not frequent waterings.	67	31	18	9	657	8	176	29	As in plot No. 2.	Ditto.	
26 / 5 / D		627 / 6,880	Frequent waterings.	62	12	11	26	683	24	111	35	As in plot No. 1.	6th May 1920 to 13th May 1920.	
26 / 6 / D		627 / 6,880	Not frequent waterings.	50	8	8	32	550	33	96	22	As in plot No. 2.	Ditto.	

Ploughing	...	...	... 6
Harrowing	...	...	... 6
Sohaging	...	...	... 2

Sown on 19th October 1919 on ridges.

Hoeings	...	...	... 2

Harvesting—21st April 1920 to 13th May 1920.

Statement No. 61.

SHOWING THE RESULTS OF DIFFERENT NO. OF WATERING WITH WHEAT TYPE XI GROWN AT THE LYALLPUR AGRICULTURAL STATION DUBING RABI 1919-20.

No. of square, block and plot.	No. of sub-plot.	Variety.	Area in marlas.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	Irrigations with dates.	Remarks.
43 1—b A	a-1	Wheat Punjab Type XI.	4·28 marlas.	0	21	4	19	34	6	13th December 1919 ...	One irrigation in all.
	a-2			0	25	0	23	14	9	13th December 1919 and 5th February 1920.	Two irrigations in all.
	a-3			0	27	0	25	9	6	13th December 1919, 5th February 1920, and 17th February 1920.	Three do. do.
	a-4			0	28	8	26	25	7	13th December 1919, 5th February 1920, 17th February 1920 and 5th March 1920.	Four do. do.
	a-5			0	28	12	26	35	0	13th December 1919, 5th February 1920, 17th February 1920, 5th March 1920 and 30th March 1920.	Five do. do.
	a-6			0	24	4	22	26	9	13th December 1919, 5th February 1920, 17th February 1920, 5th March 1920, 30th March 1920 and 6th April 1920.	Six do. do.
	b-1			0	22	12	21	10	7	13th December 1919.	One irrigation in all.
	b-2			0	27	12	25	37	6	13th December 1919 and 5th February 1920.	Two irrigation in all.
	b-3			0	26	8	24	30	10	13th December 1919, 5th February 1920 and 17th February 1920.	Three do. do.
	b-4			0	25	4	23	23	14	13th December 1919, 5th February 1920, 17th February 1920 and 5th March 1920.	Four do. do.
	b-5			0	26	2	24	16	10	13th December 1919, 5th February 1920, 17th February 1920, 5th March 1920 and 30th March 1920.	Five do. do.
	b-6			0	25	14	24	7	5	13th December 1919, 5th February 1920, 17th February 1920 5th March 1920. 30th March 1920, and 6th April 1920.	Six do. do.
	c-1			0	19	4	17	39	10	13th December 1919 ...	One irrigation in all.
	c-2			0	25	0	23	14	9	13th December 1919 and 5th February 1920.	Two irrigation in all.
	c-3			0	25	4	23	23	14	13th December 1919, 5th February 1920 and 17th February 1920.	Three do. do.
	c-4			0	26	12	25	0	0	13th December 1919, 5th February 1920, 17th February 1920 and 5th March 1920.	Four do. do.
	c-5			0	28	12	26	34	12	13th December 1919, 5th February 1920, 17th February 1920, 5th March 1920 and 30th March 1920.	Five do. do.
	c-6			0	28	0	26	6	12	13th December 1919, 5th February 1920, 17th February 1920, 5th March 1920, 30th March 1920 and 6th April 1920.	Six do. do.

	Mds.	Srs.	Chtks.
Average with one irrigation per acre	19	28	2½
" " two irrigations per acre	24	8	13½
" " three " " "	24	21	4⅔
" " four " " "	25	8	1⅓
" " five " " "	26	2	2
" " six " " "	24	20	3½

Annual Report of the Gurdaspur Agricultural Station for the year ending June 30th, 1920.

Introductory.—I have held charge of the Agricultural Station at Gurdaspur since the afternoon of 6th April 1920, so that it has been under my control for only 3 last months of the year under report.

History.—Brief history of the farm has already been given in former reports. It was started in 1910, with the primary object of testing and improving sugarcane crops. Since then experiments have been carried out in testing various varieties of wheats and other minor crops and their returns with the use of artificial fertilizers.

Area.—With the addition of 57 acres in 1918-19 the total area of the farm is now 161 acres. It has this year been divided into four Blocks—A, B, C, and D, two of which are Chahi (well irrigated) and two Barani (dependent on rains). The numbering of the plots was inconvenient and therefore they have this year been renumbered. Blocks A and B represent the old area, whereas Blocks C and D comprise the new one. Of the latter the Block C was extremely uneven with a wide, deep, ditch in the middle and was overgrown with thorny bushes. Almost all of it has now been levelled and the ditch filled up. Block D, though not nearly so bad as C, was nevertheless uneven and irregular.

They have both been brought under cultivation and their laying out has practically been finished. Plot 13 in Block A has been reserved and laid out to serve as a "Demonstration area." Part of it will grow all field crops of the seasons on a small scale and the rest will grow vegetables for use by the Vernacular Class, &c.

The farm together with the recently extended area does not seem enough for all sorts of experimental and research work coming within the scope of this Station, and further extension in the near future may well be contemplated.

Season and its effects upon crops—(Statement No. 1).—The total rainfall during the year under report was 30·94″ against 17·71″ of the last year, and 34·5″ which is the normal of the district. Though almost equal to the normal figure, it was not well distributed during Kharif and therefore affected the summer crops.

Heavy downpours in July and August delayed maize and other Kharif sowings, and whatever sowings were done were followed by poor germination and consequent failure of the crops altogether. Not only this, the continuous heavy showers from July to September hindered adequate preparatory tillage for the following Rabi and was thus responsible for lack of aeration and soil ventilation. A spell of dry weather from September to the end of October enabled us to tackle the barani fields and the sowing was completed in October, though in the chahi area it had to be extended into November. From December to January there were small occasional falls which did a good deal of benefit to young wheats. In February there was a severe frost for a couple of days, but its effects were mitigated with the 1½″ of rain which soon followed. The 2·32″ of rain in February and March put springs under wheat and it made excellent growth with a very imposing look throughout the farm, when all of a sudden season warmed up in April and the crop hastened to maturity. Further, hot winds accounted for some shrivelling of grain and therefore the outturns fell short of our expectations. Still our results are quite satisfactory. Average yield of barani wheats without any manure works out to be 1,358 lbs. per acre with 2,076 lbs. per acre as the highest, while the average outturn of the Chahi wheats was 1,862 lbs. per acre with 2,685 lbs. per acre as the highest.

Harvest started in the latter half of April, but was often interrupted and had therefors to be extended into May, when threshing was immediately started. A season like this brings out the usefulness of the reaping and threshing machines. The whole of the area (except very small varietal plots) were harvested with the Raja Reaper and about half was threshed with a steam thresher. With the help of these two machines we were able to bring in all our produce at about the middle of May which was nearly a month before the threshing was over in the district. We were thus able to avoid discolouring of grains or Bhusa from the rains which followed.

Crops (Kharif).—(1)—*Sugarcane varietal tests—(Statement No. 2-A).*—The chief rotation on the chahi area of the farm consists of maize, senji, sugarcane and wheat.

As a rule senji is removed for fodder in January to leave sufficiently long time for thorough preparation of land for the following sugarcane crop. But this year owing to the removal of the tube well pump to Amritsar for repairs, the senji crop was put in late and consequently cut down much later than usual. This considerably reduced the length of time for preparation of land for sugarcane and of necessity it had to be hurried and insufficient. Unsatisfactory preliminary cultivation together with faulty condition of the glazed tile drains aggravated the conditions still more. Sprouting was not sufficient in field No. 4 which required to be irrigated to make up its deficiency. Borer appeared in April and was virulent till July. This was followed by attack of mites which checked the growth of a good many plants. In July and August there was 23·18″ of rain, causing oversaturation of the soil and growth of weeds in abundance. These effects were intensified by bad drainage and the set back the crop thus got did not allow it to regain its lost ground. It is therefore no wonder if our outturns do not compare favourably with those of the previous years. There were five varieties under trial. In one of these Behar cane again tops the list, giving an average of 3,280 lbs. of gur per acre in field No. 3, while it is second to Yuba in field No. 4 with outturns of 2,872 lbs. and 3,408 lbs. per acre respectively. If the average of both fields is taken, Yuba

takes the first place and Behar the second, and as was the case last year the third place has been occupied by J 105 with 2,624 lbs. of gur per acre. Newly imported Suretha is fourth, with 2,456 lbs., acclimatized Suretha fifth, with 2,376 lbs.; and Dhaulu is the last, with 1,888 lbs. per acre. Except in the case of Yuba and Behar which have this year exchanged places, the figures confirm our last year's results and remarks. Yuba differs in possessing deep green coloured stems from those of Behar which are light green and but for Yuba ripening later than Behar they are both practically similar. Stature in Yuba does not seem to be a fixed character and is likely to change under different conditions. J 105 is the earliest ripening variety and possesses a delicate root system. Its sets when buried before sowing (as is the common custom with all other varieties) seem to undergo some change and lose their vitality and it will perhaps be better to leave the crop intended for sowing, standing until the sowing time, if severity of season permits. But this is only a conjecture and requires confirmation. This year results of outturns corroborate last year's remarks on susceptibility of Suretha to climatic and soil changes. The outturn from the newly imported Suretha seed is greater by 80 lbs. than that of the seed grown for a couple of years at Gurdaspur, and it will be interesting to watch their further relation with each other and to see how long the old seed will take to give no appreciable return.

Dhaulu, though last of all in outturn, has a very high sucrose content 17·1 (Statement No. 2-B).

Besides these, about 16 Coimbatore seedlings (imported from Madras) have been tested in order to find out if any of these will flourish in this climate. Out of these only five have so far given good results and have been recommended by the Government Sugarcane Expert, Madras, for comparative tests on field scale both in Chahi and Barani areas. Coimbatore 202 and Coimbators 205 are being tested in the Chahi and Barani area on the farm as well as with the zimandars for Barani only. The Coimbatore 204, 216 and 223 are grown purely Chahi. The sugar analysis and total marks obtained by each of these from maximum of ten marks for each of the 4 characters, *i.e.*, stand, vigur, habit, and tillering (awarded by the Government Sugarcane Expert, Madras) are given in Statement No. 2-B. It will be interesting to note below the pedigree and the marks awarded to these Coimbatore varieties Maximum 40 :—

Co. 202 :—	a thin seedling obtained from a stripped thick cane of Madras	33 marks.
Co. 204 :—	from a thick cane of Madras as mother and a thin cane of Dhaulu type as father.	29 „
Co. 205 :—	from a thick high sucrose, containing cane of Madras as mother and father *Sancharum spontaneum.*	32 „
Co. 216 :—	mother green sport and father Suretha	30 „
Co. 223 :—	same as 204	26 „

All these trials will be carried out for some years to arrive at definite conclusion. Behar having been found successful so far has already been given out to zimandars who like it immensely, and until some thing is found better (as Yuba this year) it will occupy the place it holds.

Manurial experiments with sugarcane—(*Statement No. 2-C*).—Tests with artificial fertilizers commenced in 1915-16. Up to the end of the last year the experiment could not be repeated every season owing to want of space and was only done once in three years, but hence forth it will be carried out in every season if space is available. This year only one fertilizer, Sodium Nitrate, at the rate of 3 cwt. per acre was used and was arranged in a duplicate set. In one case (Statement No. 2-C) the "no manure plots" beat the "manured" one, but it is *vice versâ* in the other. On the whole, when the money value is worked out the results are discouraging, there being a loss of Rs. 41-3-11 and Rs. 131-13-2 per acre.

Unfortunately the land selected for this experiment was not well prepared owing to shortage of time available and the irrigations were not satisfactory because the pump was under repairs; therefore these results are far from being conclusive, but they tend to confirm the belief that artificial manures are not likely to pay unless they can be cheaply manufactured and sold in India. This will be repeated next year.

Crushing and boiling tests of sugarcane—(*Statement Nos. 2-D and E*).—In view of the improvement and development of the sugar industry of the Province, the question of means of rapid crushing and boiling comes to the front. To start with it is important to have cane crushers capable of extracting the maximum amount of juice from a given weight of cane and to do it in the shortest possible time. To test such capacities of the crushers in hand, 7 duplicate sets were arranged and the machines tested were :-

1. Desi, two rollered.
2. Desi, three rollered.
3. Nahan.
4. Chattanooga (bullock power).
5. Chattanooga (steam engine power).
6. Hathi.
7. Desi wooden Belna.

As regards the percentage of juice extracted, the Nahan stands first with 68 per cent. and the Desi three rollered with 67, Chattanooga (steam engine power) with 62, and Hathi

with 61 follow as placed. Of course where the Chattanooga (engine power) scores, is the bulk of the cane crushed and the short time it requires to do so. This power-crusher could do ten maunds of cane in an hour.

Perhaps it will not be out of place if a brief description of the working of the power crusher and the Poona furnace is given here.

The cane is pushed into the crusher by manual force, though very slight. After being crushed the juice falls into a plastered tank, below ground surface and the begasse can be removed by means of an elevator and stacked. A force pump pumps the juice into an elevated tank whence, through gravitation, it passes by means of an under-ground pipe into the reservoir pan of the Poona furnace. The furnace consists of 4 pans adjusted in such a way as to economise use of fuel and to make use of the maximum amount of the heat produced. The reservior pan is placed on highest level and gets the surplus heat saved out of the remaining three pans. On a little lower level is another pan called the distributor. There is more heat under this than the reservoir pan. Below this there are two boiling pans worked with maximum heat. In these the juice is boiled into gur. Each of these can hold 12 maunds of juice while the first two can command 24 maunds each. It will be seen from the large quantities of juice handled at once that some means of continuous supply of juice into the reservoir tank is called for and therefore some power crusher is always required. Unfortunately the present crusher is not sufficient to supply the full amount of juice required by the Poona furnace and therefore either crusher double the size of the present one or a second crusher will have to be installed by its side. This year's results are given in Statement No. 2-E.

We have got three centrifugal machines for making raw and refined sugar, but the figures and details of the results are not to hand yet. It is proposed to give them a wider trial next year.

(2) *Maize varietal tests.*—As a rule several maize varieties are grown to find out which of them is the heaviest yielder of grain and suitable fodder; but unfortunately owing to capricious weather in July and August they could not all be sown and those that were hazarded failed to mature. Some local maize only came to maturity.

Manurial experiments with maize.—Owing to the failure of crops these results were nullified.

(3) *Cottons.*—Economic Botanist's environment experiments are going on as usual.

(4) *Bajra, Beans, Mash, and Til* were among the other Kharif crops of the farm Owing to adverse weather conditions no crop except beans (Sword beans) and bajra gave any results.

(5) *Potatoes.*—Manurial experiments on this crop were started last year and continued during this year. Though the manure crop gave an increase of 2,657 lbs. per acre over the unmanured last year and gave a profit of Rs. 62-14-3, the results obtained this year are rather discouraging. The experiment was arranged in four plots, one being unmanured and the other three received Soda Nitrate at the rates of 1, 2, and 3 maunds per acre. In each case there is decidedly a loss (Statement No. 6). The crop was sown very late, and this is only the second year of trial; therefore it is too early to form any opinion. The experiment will continue for a number of years before definite results could be arrived at.

Rabi.—1. *Wheat.*—Owing to heavy and continuous rains during July and August the preliminary cultivation for the Rabi could not be done in time in the chahi area and therefore growth of rank grass and weeds was in abundance. The barani area being high and well drained was ploughed and sown before the chahi area could be got at and consequently sowing of the latter was done rather late (November). The germination was ideal throughout and there was no need of any irrigation until the end of March when the only irrigation was given. But as ill luck would have it, this irrigation was immediately followed by strong winds which lodged 8-A in particular along with several other varieties. Even the barani fields could not be worked properly until September when dry weather enabled us to push through the sowings which were completed by the end of October. Germination all over the barani area was also quite satisfactory and the crop passed through ideal conditions in general throughout winter. Comparatively cool weather in March and early April delayed harvest, but blowing of hot winds during the latter part of April shrivelled the grains to some extent which caused some decrease in the yields. The average outturn of the whole of the barani area without any manure is 1,358 lbs. per acre as against 1,289 lbs. of the farm last year and 870 and 615 lbs. per acre of the district for this and the previous year, respectively. The highest barani outturn of the farm has been 2,076 lbs. per acre against 1,724 lbs. of the year. This clearly shews what good cultivation can do.

The following experiments have been carried out with wheat:—

(1) Comparative varietal tests in chahi area.
(2) " " " " barani "
(3) Cultivation experiments with wheats in the barani area.
(4) Manurial experiments with chahi and barani wheats.

Comparative varietal tests in chahi area—(Statement No. 3).—The following types were under test in field No. I:—8-B, Pusa 12, Punjab 17, Punjab 17 B, G_1, G_2 and G_3 with 8-A as standard. In the beginning of April when 8-A was badly lodged it appeared as if the yield was going to be reduced, but despite lodging it has been found to be the heaviest yielder on

the farm. It has given 1,850 lbs per acre as its highest outturn and 1,681 lbs per acre as an average of 15 plots. Other types in order of merit from the average of two plots stands as under :—

Pusa 12	...	...	...	1,618	lbs	per acre.
8-B	...	...	...	1,481	„	„ „
Punjab 17	...	...	...	1,459	„	„ „
G_3	...	...	...	1,421	„	„ „
Punjab 17-B	...	...	...	1,364	„	„ „
G_2	...	...	...	1,284	„	„ „
G_1	...	...	...	1,201	„	„ „

8-A *versus* 8-B (field No. 2-A, Block A)

Last year 8-B stood first with 2,733 lbs per acre and 8-A came 2nd with 2,570 lbs per acre, but the decrease in yield of 8-A was mainly due to lodging. This year although 8-A was badly lodged throughout the farm, it has held its own against 8-B. The average yields of 8-A and 8-B in this test are :—

8-A	...	...	...	1,898	lbs per acre.
8-B	...	...	...	1,541	„ „ „

Thus 8-A has beaten 8-B by 357 lbs per acre.

8-A *versus* G_1 and G_2 (field No. 11, Block A).

G_1 and G_2 are NH_{98} XP_4 and NH_{53} XP_4 of the last year. They have for the sake of brevity been called as G_1 and G_2 (G representing "Gurdaspur selection"). Last year they gave outturns of 45 and 42 maunds per acre, respectively, while grown on small scale and it was resolved to test them on a field scale this year to see how they compare with 8-A. Here, too, 8-A has taken the top with an average outturn of 2,494 lbs per acre from five bits, while G_2 gave 2,478 lbs and G_1 2,356 lbs per acre from an average of two bits.

Trials between various crosses, *e.g.*—

Cross 3	...	...	...	Economic Botanists,
NH_{48} XP_4	...	...	...	Mr. Howard's wheats.
NH_{165} XP_4	...	...	...	
NH_{80} XP_4	...	...	...	
G_1	...	...	...	
G_2	...	...	...	
13-C	...	...	...	Imported from Cawnpore,

were carried out in field No. 16, Block A. Cross 3 was grown for the first time, while the remaining types have been grown for a number of years on a small scale. G_2 gives the highest outturn (2,398 lbs per acre), while cross 3 with 2,054 lbs per acre is the last.

Comparative varietal tests of barani wheats—(*Statement No. 3 continued*).—The following varieties were under test:—

8-A	...	...	...	Mr. Milne's selections,
20-C	...	...	...	
8-B	...	...	...	
17-B	...	...	...	
Punjab 17	...	...	...	Local beardless wheat,
Punjab 13	...	...	...	Local bearded wheat,
Pusa 12	...	...	...	Mr. Howard's, and
Punjab 14	...	...	...	as standard.

The test was triplicated in the old area (Block B) and duplicated in the new area (Block C). Though the results differ in different plots, 8-A seems to be the premier barani wheat immediately followed by Punjab 14 and 17-B in Block B. But in field No. 2 of Block C, Punjab 14 has yielded more than 8-A. Pusa 12 has not done well this year. Punjab 13 was grown in one bit only and gave 1,242 lbs per acre. It seems to be promising type and will be tried on a larger scale next year. Punjab 17 does not prove to be a barani wheat and stands last, 8-B requires further trials in the barani.

From Statement No. 3, in Block C, field No. 5, it will be seen that Pusa 12 and 8-A were tested against Punjab 14 as barani wheats on 9 acres. The results obtained confirm 8-A as the best yielder in the barani area, with Punjab 14 as second, Pusa 12 the third.

Their respective results are given below :—

(1) 8-A with 1,617 lbs average of 5 bits.
(2) Punjab 14 „ 1,357 „ „ „ 11 „
(3) Pusa 12 „ 1,184 „ „ „ 5 „

Pusa 12 is well established with the zimandars, but is likely to be ousted by 8-A which has proved to be the best wheat in hand both for irrigated as well as barani lands. 17-B is

susceptible to rust and is beardless and as long as Pusa 12, which is also beardless, holds favour with the zamindars, 17-B cannot make any progress outside. 20-C is always badly attacked by rust, is beardless and a low yielder. It will be discarded next year.

Messrs. Howard and Milne's crosses were tried in the barani area this year (Statement No. 3, field No. 11, Block B.) Here cross C has done best with 1,231 lbs per acre. It is a bearded wheat with black awned long ear and white grain. It seems to be a suitable wheat for barani tracts particularly on Bet lands where it has beaten 8-A with the zamindars. It will be tested on a wider scale both in chahi and barani areas of the farm next year.

Cultivation experiments with wheats—(*Statement No. 4-A*).—The experiments consisted of the following :—

(*a*) Harrowing *versus* no harrowing.
(*b*) Sabul plough *versus* the Desi.
(*c*) Raja plough *versus* the Desi.
(*d*) Permanent wheat plot.
(*e*) Permanent wheat and gram plot.

(*a*) *Harrowing* versus *no harrowing*.—The object of harrowing a crop is to break the crust which may be produced after rain and to produce a mulch to conserve moisture. Besides these two it encourages tillering. As remarked last year its usefulness is more marked in a year of scanty rainfall and under such conditions it has given increased yields. But during the year under report the season has been very favourable and there was no particular shortage of moisture in the soil. Therefore harrowed portions can show no increase over the unharrowed rather on the contrary. 'No harrowing' has given 94 lbs more than the harrowed crop. Start of the crop, as last year, was undoubtedly better in the case of harrowed bits and the crop showed a healthier and more robust appearance, but after the rains in December and January the unharrowed plots picked up wonderfully and in the end have yielded more than their competitor. But this is only in a year like this, and one to be on the safe side should always resort to harrowing young wheats. A little expenditure at Re. 0-6-0 per harrowing might help the crop in future and more than repay its cost and labour.

(*b*) *Sabul* versus *the Desi*—Gave 1,822 and 1,668 lbs., respectively, with an increase of 154 lbs in the case of the former.

Profit and loss per acre stands as follows :—

	Rs.	A.	P.
Hire of 4 pairs of bullocks (at Re. 1-8-0 per pair) to plough an acre with Sabul.	6	0	0
Hire of 2 pairs of bullocks (at Re. 1-8-0 per pair) to plough an acre with Desi.	3	0	0
Extra cost with Sabul	3	0	0
Difference of 154 lbs at Rs. 4-8-0 per 82 lbs in favour of Sabul	8	7	3
Therefore profit per acre with Sabul	5	7	3

Depreciation and interest on the capital invested in the purchase of the Sabul plough and the value of straw have been neglected. This confirms last year's results, though the profit obtained by the use of Sabul is only Rs. 5-7-3 against Rs. 19-11-0 of the last year. This again shows that the advantage of deep cultivation is more apparant in a year of scanty rainfall.

(*c*) *Raja* versus *Desi plough*.—The Raja has given an increase of 510 lbs per acres. Except for two ploughings with the Desi for every one ploughing by the Raja, all other operations were similar.

The cost and outturns compare as below :—

		Rs.	A.	P.		
Cost of two Desi ploughing	...	3	0	0	per	acre
Cost of 1 Raja ,,	...	1	8	0	,,	,,
Extra cost against Desi ploughing	...	1	8	0	,,	,,

	Rs.	A.	P.
Increase of outturn in favour of Raja, 510 lbs at Rs. 4-8-0 per 82 lbs ...	28	0	0
Total profit per acre ..	29	8	0

Extra cost of Bhusa as well as depreciation and interest have been disregarded as under Sabul and Desi.

Here also last year's results are confirmed. The total gain per acre last year was Rs. 9-8-9, while this year it is Rs. 29-8-0, inspite of the fact that the produce was sold at Re. 0-8-0 per maund more last year than this.

(*d*) *Permanent wheat plot*—Has given 1,003 lbs per acre and the permanent wheat and gram plot 1,044 lbs. with 806 lbs of wheat and 238 lbs of gram. I have nothing further to add to last year's remarks.

Manurial experiments with barani wheats (*Statement No. 5-A*).—Two wheats 8-A and Punjab 14 were treated with bone meal at 5 cwt. and Superphosphate got 1½ cwt. per acre to see if any of these manures will increase the yield. In case of bone meal the highest outturn

has been 1,956 lbs per acre of Punjab 14 wheat, while 1,908 lbs is the next from "no manure" plot of 8-A. Financially application of bone meal has been a loss throughout the experiment. The highest yield with Superphosphate has been 1,806 lbs per acre of Punjab 14, while the no manure plot of 8-A stood next with 1,650 lbs. per acre. Thus Superphosphate has again this year given a profit of Rs. 4-10-9, while bone meal has shown a loss of Rs. 11-13-0 per acre, but as bone meal is not readily soluble in soil and requires some time to decay, its residual effects will be watched and therefore no conclusions can be drawn yet.

Experiments with Ammonium Sulphate, Superphosphate and bone meal in another barani field have all shown a loss (Statement No. 5-B) except two bits, one with a complete manure, *i.e.,* Ammonium-Sulphate plus Superphosphate plus bone meal and the other with Ammonium Sulphate and Superphosphate only. This same will be repeated next year.

Green manuring versus *following in barani area—(Statement No. 5-C).*—In too plots Guara was removed during Kharif and was ploughed in the 3rd ; while three such bits were allowed to remain fallow as usual. Wheat was grown in the following Rabi. This is the first year of its trial and will continue for a number of years.

Manurial experiments with ahahi (irrigated) wheats—(Statements No. 5-D and 5-E.)—These experiments are continuation of the previous year's and the object was to see the residua effects of fertilizers when used in conjunction with green manure and when used by themselves. They all show a loss except one where lime and Ammonium Sulphate were used. Bone meal plus Ammonium Sulphate plus Superphosphate used in conjunction with a green manure also show a loss.

2. *Other Rabi crops* on the farm were gram, oats, flax and mustard. Varietal tests of grams were again carried out this year with four of the Economic Botanist's selections in the barani area (Statement No. 7) with the local type as standard. To this were added for the first time the two Kablis, *i. e.,* large and small varieties.

They came out in the following order of merit :—

(1) Economic Botanist's Register No. 17
(2) ,, ,, ,, ,, 7
(3) ,, ,, ,, ,, 15
(4) ,, ,, ,, ,, 20
(5) Local.
(6) Kablis, small.
(7) Kablis, large.

Poultry.—There are four breeds now kept on the farm. The leghorns, Rhode Island reds, buff orpingtons and white orpingtons and the only Aylesbury breed of ducks. Demand for the eggs and birds of the English breeds has greatly increased this year, and inspite of the price being doubled from Re. 0-2-0 to Re. 0-4-0 per egg, the demand is more than we can meet New wooden trellis rooms have been constructed for each breed to be closed in at night during hot season, but inspite of every effort the birds have heavily succumbed to the effect of heat, which together with fowl cholera accounted for a good many deaths.

No separate staff or budget has so far been supplied for the poultry, but as the work has increased now, it will have to be considered. An Incubator (Hearson's) and a Foster mother were imported and worked during this year.

Miscellaneons.—The pump of the tube well seems to have been worn out, and inspite of repairs during the past two years it has not been giving an adequate discharge. It will perhaps have to be replaced.

The oil engine does not seem to be enough to work all the different power plants which are to be set up, *viz.*,—crusher, chaff cutter and a centrifugal for sugar manufacture. Besides, it consumes one tin for every 3½ hours of its work which is very expensive when such tins now cost Rs. 4-8-0 each. A crude oil engine with a greater horse power might improve matters.

The farm is now growing maximum amount of wheat and it is not easy to secure labour during threshing. This year too the old thresher from Sargodha saved our crop from getting wet. This is very old and does not work satisfactorily, and the purchase of a new one is being arranged.

Sarai.—The construction of the sarai is almost completed. It will now remove all inconveniences the visitors were put to when they come in parties to the farm and had to stay for a day or two. Accommodation will also be now available for the Vernacular class which will soon be started here.

Visitors.—The farm has tremendously increased in popularity and is much frequented for purchase of seed, implements, and to take advice. The Hon'ble Mr. P. J. Fagan and the members of the Sugarcane Committee under the presidency of Mr. J. Mackenna, I. C. S., were our distinguished visitors.

Staff.—M. Mukhtar Nabi has been in charge of the farm throughout the year and has done most excellent work in the capacity of a manager.

Acknowledgments.—Mr. M. L. Darling, I.C.S., has continued his keen interest in the popularity of the farm as usual and has brought the zamindar into close touch with the work going on here. Many thanks are also due to H. Harcourt, Esquire, I.C.S., Deputy Commissioner of Gurdaspur.

M. SULTAN ALI,

The 21st July 1920. *Deputy Director of Agriculture, 1st circle, Gurdaspur.*

Statement No. 1.

RAINFALL.

Number.	Rainfall during the year 1913-19. Months.	Rainfall in inches.	Rainfall during the year 1919-20. Months.	Rainfall in inches.	Remarks.
1	July 1918	2·27	July 1919	14·44	
2	August 1918	3·80	August 1919	8·74	
3	September 1918...	0 75	September 1919	0·66	
4	October 1918	...	October 1919	...	
5	November 1918	0·28	November 1919	0·25	
6	December 1918	0·36	December 1919	1·69	
7	January 1919	6·08	January 1920	0·89	
8	February 1919	0·94	February 1920	1·48	
9	March 1919	0·35	March 1920	0·84	
10	April 1919	0·17	April 1920	0·11	
11	May 1919	2·06	May 1920	0 68	
12	June 1919	0·65	June 1920	1·16	
	Total ...	17 71	Total ...	30·94	

Statement No. 2-A.

VARIETAL TEST OF SUGARCANE.

Field No.	Name of variety.	Area harvested, in square yards.	Actual weight in lbs. of Cane.	Juice.	Gur.	Outturn per acre in lbs. of Cane.	Juice.	Gur.	Percentage of Gur to juice.	Gur to canes.	Juice to canes	Dates of watering.	Remarks.
A 1/3	Behar ...	605	4,448	2,706	410	35,534	21,648	3,280	15·15	9·217	60·83	(1) 29th May 1919. (2) 21st June 1919. (3) 27th Septr. 1919. (4) 29th Octr. 1919.	
A 1/3	Yuba ...	726	4,520	2,542	430	30,133·3	16,947	2,867	16·91	9·513	56·23		
A 1/3	J. 105 ...	605	3,413	2,152	328	27,304	17,216	2,624	15·24	9·610	62 05		Spoilt by jackals. Also lodged.
A 1/4	Dhaulu ...	605	2,521	1,353	236	20,168	10,824	1,888	17·44	9 361	53·66	(1) 30th May 1919. (2) 22nd June 1919. (3) 28th September 1919. (4) 1st November 1919.	Germination meagre. Extra irrigation given to it in early May. The plot is high lying.
A 1/4	Suretha acclimatized.	605	3,260	1,746	297	26,030	13,938	2,376	17·01	9·11	53·55		Lodged badly. Very difficult to tie it up after lodging.
A 1/4	Yuba ...	605	4,776	2,644	426	38,208	21,152	3,408	16·11	8·919	55·36		
A 1/4	Behar ...	605	3,833	2,296	359	30,664	18,368	2,872	15·63	9·366	59·90		
A 1/4	Suretha imported	605	3,597	1,886	307	28,776	15,088	2,456	16·27	8·534	52·43		Lodged badly. Very difficult to tie it up after lodging.

Statement No. 2-B.

ANALYSIS OF SUGARCANE VARIETIES GROWN AT GURDASPUR AGRICULTURAL STATION DURING 1919-20.

Number and date of sampling and name of variety.	Description of cane sampled.				Juice.	Sucrose.	Glucose.	Total sugars.	Total Solids Brix at 17·5 oc.	Purity co-efficient.	Glucose ratio.	Marks awarded by Sugarcane Expert from total of 40.	Remarks.
	Colour.	Average length of 10 canes.	Average length of 10 internodes in centimetres.	Thickness in centimetres.									
1. 4th January 1920 Dhaulu.	Greenish white.	155·6	9·7	1·18	47·83	17·1	0·49	17·50	19·52	87·09	2·88	29	Co. = Coimbatore. J. = Java.
2. 4th January 1920 Suretha.	Pink	179·1	13·7	1·46	58·87	14·66	1·79	16·45	19·10	76·78	12·21	Not considered.	
3. 4th January 1920 J. 105.	Dark green.	153·0	10·0	2·2	67·56	13·95	2·53	16·48	18·25	76·43	18·13	18	
4. 5th January 1920 Behar.	Whitish green.	156·6	12·8	1·79	58·5	13·89	2·47	16·27	17·68	78·05	18·28	32	
5. 5th January 1920 Yuba.	Green	138·4	12·8	2·01	66·31	13·51	2·43	15·94	17·68	76·40	15·03	31	
6. 5th January 1920 Co. 202.	Blackish pink.	131·6	14·0	1·6	60·01	12·79	0·98	13·77	16·26	78·65	7·66	38	
7 6th January 1920 Co. 204.	Blackish teru.	182·2	14·1	1·33	56·20	12·12	1·71	12·88	15·15	80·00	6·27	29	
8. 6th January 1920 Co. 205.	Greenish pink teru.	179·6	14·4	1·48	63·08	12·41	1·83	14·24	15·53	79·91	14·75	32	
9. 6th January 1920 Co. 216.	Pink	174·7	12·7	1·75	60·03	12·20	0·97	13·17	14·28	85·45	7·95	30	
10. 7th January 1920 Co. 223.	Pink	163·0	14·2	1·7	66·95	11·49	0·95	15·04	16·72	87·68	6·53	26	

Statement No. 2-C

SHOWING THE RESULTS OF MANURIAL EXPERIMENT WITH SUGARCANE.

Number of field.	Name of variety.	Treatment.	Area harvested in square yards.	Weight of canes in lbs.	Weight of juice in lbs.	Weight of gur in lbs.	Weight of canes per acre in lbs.	Weight of juice per acre in lbs.	Weight of gur per acre in lbs.	Percentage of juice to canes.	Percentage of gur to juice.	Percentage of gur to canes.	Increase or decrease of gur per acre in lbs.	Increase or decrease in money when gur sells at Rs. 7 per maund.	Price of manure.	Profit or loss.	Remarks.
														Rs. A. P.	Rs. A. P.	Rs. A. P.	
D 1	Yuba	No manure ...	302½	1,671	922	141	26,736	14,752	2,256	55·1	15·2	8·4	...	...	...	...	
	Do.	Sodium nitrate at the rate of 3 cwt. per annum.	302½	1,322	733	95	21,152	11,808	1,520	55·8	12·8	7·1	—736	—62 13 2	69 0 0	—131 13 2	
	Do.	No manure ...	302½	1,209	717	100	19,344	11,472	1,600	59·3	13·9	8·2	...	...	...	...	
	Do.	Sodium nitrate at the rate of 3 cwt. per annum.	302½	1,035	627	113	16,560	10,032	1,808	60·5	18·0	10·9	+208	+17 12 1	69 0 0	—41 3 11	

Dates of watering ... (1) 15th April 1919.
(2) 29th April 1919.
(3) 7th June 1919.
(4) 29th June 1919.
(5) 25th September 1919.
(6) 15th October 1919.
(7) 4th November 1919.

Statement No. 2-D.

COMPARATIVE TESTS OF DIFFERENT CANE CRUSHERS (1919-20).

Serial No.	Kind of cane crushers.	Variety of cane crushed.	Weight of cane.	Number of cane.	Actual time.	Weight of juice obtained.	Per cent. of juice.	Time taken in crushing one maund of cane.	Labour employed.	Remarks.
			Mds. Srs.		H. M.	Mds. Srs		H. M.		
1	Desi two rollered ...	Yuba ...	2 20	250	0 55	1 18	58	0 22	2 men and one pair of bullocks.	
2	Ditto ...	Dhaulu ..	1 25	405	0 48	0 33½	51·5	0 29½	Ditto.	
3	Desi three rollered ...	Yuba ...	2 20	259	0 45	1 27	67	0 18	Ditto.	
4	Ditto ...	Dhaulu...	2 20	536	1 15	1 15	55	0 30	Ditto.	
5	Nahan Sultan pattern ...	Yuba ...	2 20	280	0 30	1 28½	68·5	0 12	Ditto.	
6	Ditto ...	Dhaulu	4 0	866	1 15	2 8	55	0 19	Ditto.	
7	Chattanooga bullock power	Yuba ...	2 20	285	0 33	1 19	59	0 13	Ditto rather heavy for one pair.	
8	Ditto ...	Dhaulu .	4 0	861	1 9	2 8	55	0 17	Ditto.	
9	Hathi	Yuba ...	2 20	283	0 57	1 21	61	0 22	Ditto slow and heavy.	
10	Do.	Dhaulu ..	4 0	862	2 15	2 6	53·75	0 34	Ditto.	
11	Desi wooden rollered ...	Yuba ...	2 0	279	0 51	1 2	52·5	0 25½	4 men and 2 pairs, sometimes 5 men and 3 pairs.	
12	Ditto ...	Local Kathia of Jullundur.	2 0	433	0 58	0 39	48·75	0 29	Ditto.	
13	Chattanooga power ...	Yuba ...	10 0	1,115	0 57½	6 8	62	0 6	3 men besides engine driver.	
14	Ditto ...	Dhaulu ..	10 0	1,970	1 4	5 16	54	0 6½	Ditto.	

Statement No. 2-E.

RESULTS OF POONA FURNACE.

Date.	North Furnace.				South Furnace.				Remarks.
	No. of boiling.	Time.	Fuel.	Juice.	Gur.	Time.	Fuel.	Juice.	Gur.	
		H. M.	Mds. Srs.	Mds. Srs.	Mds. Srs.	H. M.	Mds. Srs.	Mds. Srs.	Mds. Srs.	
15th April 1920 ...	1st ...	1 51	3 10	8 0	0 38	1 40	3 10	8 0	1 9	About 3 maunds of juice spoiled from North furnace.
Ditto ...	2nd ...	0 57	2 5	5 20	0 39	1 27	3 0	8 0	1 4	Total juice worked 130 maunds.
Ditto ...	3rd ...	1 37	2 10	8 0	1 16	1 23	2 5	8 0	1 4	Total gur obtained 19 maunds 26 seers.
16th April 1920 ...	1st ...	2 23	4 10	8 0	1 7	1 48	4 15	8 0	0 37	Total fuel spent 53 maunds 4 seers.
Ditto ...	2nd ..	2 1	3 31	10 0	1 33	1 46	2 35	8 0	1 7	Total time spent in boiling —26 hours 49 minutes.
17th April 1920 ...	1st ...	2 1	4 20	8 0	1 6	1 38	3 32	8 0	1 10	Per cent. gur to juice 15.
Ditto ...	2nd ...	1 41	3 0	8 0	1 7	1 6	3 20	8 0	1 7	
Ditto ...	3rd ...	1 38	3 13	9 10	1 21	1 42	3 28	9 10	1 21	
Total ...	...	14 9	26 19	64 30	10 7	12 30	26 25	65 10	9 19	

COMPARATIVE TESTS OF WHEAT IN CHAHI.

Statement No. 3.

COMPARATIVE TESTS OF WHEAT IN CHAHI.

No. of field.	Area harvested in square yards.	Name of variety.	Date of sowing.	Date of earing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Details of cultivation.	Remarks.
						Grain.	Straw.	Grain.	Straw.		
A/1	761	8-A ...	12th November 1919	4th March 1920 ...	26th April 1920 ...	291	937	1,850	5,959		Lodging 80 per cent., crop thick, average height 4 feet.
	745	8-B ...	Ditto	27th February 1920	24th April 1920 ...	286	772	1,728	5,015		Lodging 80 per cent., crop thick, average height 4½ feet.
	761	8-A ...	Ditto	4th March 1920 ...	Ditto ...	291	879	1,850	5,590		Lodging 58 per cent., height 4 feet.
		Pusa 12 ...	Ditto	22nd February 1920	20th April 1920 ...	273	662	1,736	4,210		Lodging 65 per cent., height 4 feet, smut 4 per cent.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	291	703	1,850	4,471		Lodging 32 per cent., height 4 feet.
		Punjab 17 ...	Ditto	2nd March 1920 ...	23rd April 1920 ...	243	592	1,545	3,765		Lodging 12 per cent., height 4½ feet.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	278	639	1,768	4,064		Lodging 40 per cent, height 4 feet.
		17-B ...	Ditto	2nd March 1920 ...	23rd April 1920 ...	224	570	1,424	3,625		Lodging nominal, height 3¾ feet, stand thin. Rust.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	235	574	1,494	3,650		Lodging 44 per cent., height 4 feet.
		G_1 ...	Ditto	20th February 1920	20th April 1920 ...	202	492	1,284	3,129		No lodging, height 4 feet, good stand.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	206	559	1,310	3,555		No lodging, height 3¾ feet, crop thick.
		G_2 ...	Ditto	20th February 1920	20th April 1920 ...	189	471	1,202	2,995		No lodging, height 3¾ feet, crop thick.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	220	563	1,399	3,580	Raja plough 2	No lodging, height 3¾ feet, thin and irregular crop.
		G_3 ...	Ditto	5th March 1920 ...	23rd April 1920 ...	232	574	1,475	3,650	Country plough ... 6 Spring toothed harrow ... 4	No lodging, height 4½ feet, thick stand.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	240	610	1,526	3,879	Sohaga 4	Lodging 40 per cent., height 3¾ feet, thick stand.
		8-B ...	Ditto	27th March 1920 ...	24th April 1920 ...	194	547	1,233	3,478	Wheat harrowing ... 4	No lodging, height 4 feet, thick stand.
	761	8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	261	553	1,659	3,517	Irrigation 1 on 26th March, besides one for sowing.	No lodging, height 4 feet, thick stand.
		Pusa 12 ...	Ditto	22nd March 1920 ...	20th April 1920 ...	236	453	1,500	2,881		Lodging nominal, height 4 feet, smut 2 per cent.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	273	645	1,736	4,102		Lodging 33 per cent., height 4 feet, very thick stand.

		Punjab 17 ...	Ditto	2nd March 1920 ...	23rd April 1920 ...	216	596	1,373	3,315			Lodging nominal, height 4½ feet, good heavy crop.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	244	596	1,551	3,790			Lodging 20 per cent., height 4½ feet, thick stand.
		17-B ...	Ditto	2nd March 1920 ...	23rd April 1920 ...	205	451	1,303	2,868			No lodging, height 4 feet, stand good. Rust.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	285	606	1,812	3,854			No lodging, height 4½ feet, irregular, but good stand.
		G_1 ...	Ditto	20th February 1920	20th April 1920 ...	176	451	1,119	2,868			No lodging, height 4½ feet, thick crop.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	274	529	1,742	3,354			Lodging 20 per cent., height 4 feet.
		G_2 ...	Ditto	0th February 1920	20th April 1920 ...	215	492	1,367	3,129			No lodging, height 4½ feet, thin stand, but bigger head than G_1.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	287	723	1,825	4,598			Lodging 50 per cent., height 4 feet.
		G_3 ...	Ditto	5th March 1920 ...	23rd April 1920 ...	215	574	1,367	3,650			No lodging, height 4½ feet, very good crop.
		8-A ...	Ditto	4th March 1920 ...	26th April 1920 ...	287	740	1,825	4,693			Lodging 50 per cent., height 4 feet.
A — 2a	975	8-A ...	2nd November 1919	3rd March 1920 ...	23rd April 1920 ...	894	2,285	1,955	6,279	Raja plough ... ... 1 Country plough ... 5 Spring toothed harrow ... 3 Sohaga ... 5 Wheat harrow ... 4		Lodging 38 per cent, average height 4½ feet, very good crop.
		8-B ...	Ditto	28th February 1920	Ditto ...	330	935	1,638	4,641			Lodging 12 per cent, average height 4½ feet, stand good.
		8-A ...	Ditto	3rd March 1920 ...	Ditto ...	371	813	1,841	4,035	Date of irrigation—23rd March 1920, besides one for sowing.		Lodging 30 per cent., average height 4 feet, irregular but thick.
		8-B ...	Ditto	28th February 1920	Ditto ...	291	607	1,444	3,013			No lodging, average height 4½ feet, regular.
A — 11	539	8-A ...	22nd October 1919	27th February 1920	26th April 1920 ...	256	754	2 298	6,770			Lodging 55 per cent., average height 4½ feet, smut 1 per cent.
		G_1 ...	Ditto	29th January 1920 ...	15th April 1920 ...	233	465	2,331	4,175			No lodging, average height 4½ feet., splended, uniform good tillering.
		8-A ...	Ditto	27th February 1920	26th April 1920 ...	299	705	2 624	6,390	Raja plough ... 1 Country plough ... 4 Spring toothed harrow 3 Sohaga ... ... 4 Wheat harrowing ... 4 Irrigation 1 on 22nd March 1920, besides one for sowing.		Lodging 55 per cent., height 4½ feet, crop good.
		G_2 ...	Ditto	29th January 1920 ...	15th April 1920 ...	235	592	2,379	5,315			No lodging, thinner than G_1, height 4½ feet.
		8-A ...	Ditto	27th February 1920	26th April 1920 ...	237	782	2,577	7.022			Lodging 50 per cent., height 4½ feet.
		G_1 ...	Ditto	29th January 1920 ...	15th April 1920 ...	232	643	2,352	5,773			No lodging, height 4 feet.
		8-A ...	Ditto	27th February 1920	26th April 1920 ...	264	733	2,370	6,582			Lodging 44 per cent., height 4½ feet.
		G_2 ...	Ditto	29th January 1920 ...	15th April 1920 ...	287	694	2,577	6 231			No lodging, height 4 feet.
		8-A ...	Ditto	27th February 1920	26th April 1920 ...	283	681	2,541	6,115			Lodging 44 per cent., height 4½ feet.

Statement No. 3—*continued.*

COMPARATIVE TESTS OF WHEAT IN CHAHI—CONCLUDED.

No. of field.	Area harvested in square yards.	Name of variety.	Date of sowing.	Date of earing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Details of cultivation		Remarks.
						Grain.	Straw.	Grain.	Straw.			
A 16	662	Cross 3 ...	19th October 1919	5th March 1920 ...	24th April 1920 ...	281	656	2,054	4,796	Raja plough ... 1 Country plough ... 2 Spring toothed harrow ... 3 Sohaga ... 6 Wheat harrowing ... 3 Irrigation 1 on 23rd March 1920, besides one for sowing.		Thin, standing well, height 4½ feet.
		$N H_{98} \times P_4$ or G_1.	Ditto	1st February 1920 ...	19th April 1920 ...	287	648	2,098	4,737			Thin, average height 4½ feet, good stand.
		$N H_{22} \times P_4$ or G_2.	Ditto	Ditto ...	Ditto ...	328	709	2,398	5,183			Ditto ditto.
		$N H_{43} \times P_4$ ...	Ditto	1st March 1920 ...	Ditto ...	324	808	2,368	5,907			Thick crop, height 4½ feet.
		$N H_{165} \times P_4$ ...	Ditto	26th February 1920	Ditto ...	306	801	2,337	5,856			Ditto.
		$N H_{80} \times P_4$ ...	Ditto	23rd February 1920	Ditto ...	291	746	2,127	5,454			Thin, average height 4 feet.
		13-C ..	Ditto	21st February 1920	21st April 1920 ...	299	853	2,186	6,236			Lodging 37 per cent., tall growing, height 4¾ feet.

VARIETAL TESTS OF WHEAT IN BARANI.

C 2	1,353	Punjab 14 ..	18th October 1919	22nd February 1920	22nd April 1920 ...	423	834	1,513	2,983			Thick, regular, height 3¾ feet.
		17-B ...	Ditto	21st February 1920	21st April 1920 ...	309	834	1,105	2,983			Thin, regular, rust 15 per cent., height 3¾ feet.
		Punjab 14 ...	Ditto	22nd February 1920	22nd April 1920 ...	344	732	1,230	2,618			Regular, height 3½ feet.
		20-C ...	Ditto	27th February 1920	Ditto ...	315	678	1,126	2,425			Thick, regular, rust 50 per cent., height 3 feet.
		Punjab 14 ...	Ditto	22nd February 1920	Ditto ...	455	801	1,627	2,865			Very regular, height 3¾ feet.
		8-A ...	Ditto	25th February 1920	Ditto ...	394	795	1,409	2,843			Ditto ditto.
		Punjab 14 ...	Ditto	22nd February 1920	Ditto ...	268	880	958	3,147			Regular, thick, height 3¾ feet.
		8-B ...	Ditto	16th February 1920	Ditto ...	308	637	1,101	2,278			Very regular, thick, height 3¾ feet.
		Punjab 14 ...	Ditto	22nd February 1920	Ditto ...	406	608	1,452	2,174	Raja plough ... 2 Country plough ... 2 Spring toothed harrow 4 Sohaga ... 8 Wheat harrowing ... 3		Regular, height 3¼ feet.
		Pusa 12 ...	Ditto	10th February 1920	14th April 1920	236	580	844	2,074			Regular, thin, smut 2 per cent., height 3½ feet.
		Punjab 14 ...	Ditto	22nd February 1921	22nd April 1920 ...	402	760	1,438	2,718			Good stand, uniform, height 3½ feet.
		17-B ...	Ditto	21st February 1920	21st April 1920 ...	303	645	1,083	2,307			Good stand, rust 10 per cent., height 3¾ feet.

	Punjab 14 ...	Ditto	22nd February 1920	22nd April 1920 ...	371	657	1,327	2,850			Thick, regular, height 3½ feet.
	20-C ...	Ditto	27th February 1920	Ditto ...	287	678	1,026	2,425			Thin, but regular, rust 50 per cent., height 3 feet.
	Punjab 14 ...	Ditto	22nd February 1920	Ditto ...	326	596	1,166	2,182			Thick, uniform, height 3½ feet.
	8-A ...	Ditto	25th February 1920	Ditto ...	289	529	1,033	1,892			Ditto ditto.
	Punjab 14 ...	Ditto	22nd February 1920	Ditto ...	328	516	1,173	1,845			Ditto ditto.
	8-B ...	Ditto	16th February 1920	Ditto ...	246	542	880	1,938			Very thin, but uniform, height 3½ feet.
	Punjab 14 ...	Ditto	22nd February 1920	Ditto ...	254	490	908	1,752			Uneven, but thick, height 3 feet.
	Punjab 14 ...	19th October 1919	23rd February 1920	30th April 1920 ...	665	1,080	1,736	2,819			Thick, very uniform, height 3½ feet.
	8-A ...	Ditto	25th February 1920	Ditto ...	709	1,304	1,850	3,404			Fairly thick, uniform, very well looking, height 3½ feet.
	Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	659	1,304	1,720	3,404			Thick, uniform, good stand, height 3½ feet.
	Pusa 12 ...	Ditto	10th February 1920	14th April 1920 ...	545	910	1,422	2,375			Fairly thick, height 3½ feet.
	Punjab 14 ...	Ditto	23rd February 1920	30th April 1920 ...	618	1,258	1,613	3,284			Uniform, height 4 feet.
	8-A ...	Ditto	25th February 1920	Ditto ...	658	1,094	1,712	2,856			Ditto.
	Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	515	1,025	1,344	2,675			Uniform, height 3½ feet.
	Pusa 12 ...	Ditto	10th February 1920	14th April 1920 ...	475	786	1,240	2,051			Uniform, height 3½ feet.
	Punjab 14 ...	Ditto	23rd February 1920	30th April 1920 ...	494	1,056	1,289	2,756			Even stand, height 3½ feet.
	8-A ...	Ditto	25th February 1920	Ditto ...	621	970	1,621	2,532			Thick, very uniform, very good crop, height 4 feet.
C/5	Punjab 14 ... 1,854	Ditto	23rd February 1920	Ditto ...	496	1,046	1,294	2,730	Raja plough ... ... 2 Country plough ... 2 Sohaga ... ... 4 Spring toothed harrow ... 3 Wheat harrowing ... 3		Ditto ditto.
	Pusa 12 ...	Ditto	10th February 1920	14th April 1920 ...	469	880	1,224	2,297			Thick, uniform, good stand, height 3½ feet.
	Punjab 14 ...	Ditto	23rd February 1920	30th April 1920 ...	536	1,016	1,399	2,652			Very good crop, height 4 feet.
	8-A ...	Ditto	25th February 1920	Ditto ...	623	1,080	1,626	2,688			Thick, uniform, height 3½ feet.
	Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	514	1,050	1,342	2,741			Ditto ditto.
	Pusa 12 ...	Ditto	10th February 1920	14th April 1920 ...	408	640	1,065	1,670			Ditto ditto.
	Punjab 14 ...	Ditto	23rd February 1920	30th April 1920 ...	464	712	1,211	1,858			Thin, but uniform, height 3½ feet.
	8-A ...	Ditto	25th February 1920	Ditto ...	490	712	1,279	1,858			Thick, regular, height 3½ feet.
	Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	350	676	913	1,764			Not uniform, but thick, height 3 feet.
	Pusa 12 ...	Ditto	10th February 1920	14th April 1920 ...	371	590	968	1,540			Uniform, but weak and thin, height 3 feet.
	Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	409	706	1,067	1,843			Uniform, but weak and thin, height 3½ feet.

Statement No. 3—*concluded.*

VARIETAL TESTS OF WHEAT IN BARANI—CONCLUDED.

No. of field.	Area harvested in square yards.	Name of variety.	Date of sowing.	Date of earing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Details of cultivation.	Remarks.
						Grain.	Straw.	Grain.	Straw.		
B/7	1,080	Punjab 14 ...	21st October 1919	23rd February 1920	21st April 1920 ...	254	551	1,138	2,469		Uniform, good stand, height 3½ feet.
		Punjab 13 ...	Ditto	25th February 1920	Ditto ...	277	539	1,241	2,415		Uniform, good stand, height 3¾ feet.
		Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	268	486	1,201	2,178		Very thin, height 3½ feet.
		17-B ...	Ditto	24th February 1920	15th April 1920 ...	240	467	1,075	2,092		Very thin, slightly rusted, height 3¾ feet.
		Punjab 14 ...	Ditto	23rd February 1920	24th April 1920 ...	314	619	1,407	2,774		Patchy irregular, height 3½ feet.
		20-C ...	Ditto	29th February 1920	Ditto ...	260	560	1,165	2,240	Raja plough ... 1 Spring toothed harrow ... 5 Country plough ... 2 Sohaga ... ... 6 Wheat harrowing ... 3	Patchy rusted, height 3½ feet.
		Punjab 14 ...	Ditto	23rd February 1920	21st April 1920 ...	279	533	1,250	2,388		Thin, uniform, height 3½ feet.
		8-A ...	Ditto	24th February 1920	Ditto ...	336	541	1,505	2,424		Thin, uniform, height 3¾ feet.
		Punjab 14 ...	Ditto	23rd February 1920	24th April 1920 ...	271	480	1,214	2,151		Thick, uniform, height 4 feet.
		8-B ...	Ditto	22nd February 1920	Ditto ...	283	529	1,268	2,370		Thin, but uniform, height 4 feet.
		Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	303	508	1,357	2,276		Thick, height 4½ feet.
		Pusa 12 ...	Ditto	18th February 1920	15th April 1920 ...	258	426	1,156	1,909		Regular, but thin, height 3½ feet.
		Punjab 14 ...	Ditto	23rd February 1920	24th April 1920 ...	252	467	1,129	2,092		Patchy thin, height 3½ feet.
		Punjab 14 ...	16th October 1919	23rd February 1920	24th April 1920 ...	88	230	957	2,501		Uniform, thin looking, height 3½ feet.
		17-B ...	Ditto	24th February 1920	15th April 1920 ...	98	225	1,065	2,447		Uniform, thin looking, height 4 feet.
		Punjab 14 ...	Ditto	23rd February 1920	24th April 1920 ...	82	266	891	2,893		Uniform, but thinner on road side, height 3½ feet.
		20-C ...	Ditto	28th February 1920	Ditto ...	84	254	913	2,762		Uniform, thin rusted, height 3½ feet.
		Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	104	248	1,131	2,697		Thin looking, height 3½ feet.
B/8	445	8-A ...	Ditto	24th February 1920	Ditto ...	119	193	1,294	2,099	Raja plough ... 1 Spring toothed harrow ... 4 Country plough ... 2 Sohaga ... ... 6 Wheat harrowing ... 4	Ditto ditto.
		Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	102	252	1,109	2,740		Even stand, height 3¾ feet.
		8-B ...	Ditto	22nd February 1920	Ditto ...	98	221	1,065	2,403		Very good stand, height 4 feet.
		Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	94	193	1,022	2,099		Regular all over, height 3½ feet.

	Pusa 12 ...	Ditto	18th February 1920	15th April 1920 ...	88	150	957	1,631			Thin, weak under shade, height 3½ feet.
	Punjab 14 ...	Ditto	23rd February 1920	24th April 1920 ...	72	209	783	2,273			Patchy in the centre, height 3½ feet.
	Punjab 14 ...	16th October 1919	23rd February 1920	24th April 1920 ...	127	262	1,069	2,205			Regular, height 3½ feet.
	Punjab 17 ...	Ditto	Ditto	15th April 1920 ...	76	217	639	1,826			Thin, but regular, height 4 feet.
	Punjab 14 ...	Ditto	Ditto	24th April 1920 ...	125	240	1,052	2,020			Regular all over, height 3½ feet.
	17-B ...	Ditto	24th February 1920	15th April 1920 ...	109	295	917	2,483			Very uniform, rusted, height 4 feet.
	Punjab 14 ...	Ditto	23rd February 1920	24th April 1920 ...	139	232	1,170	1,952			Regular, height 3¾ feet.
	20-C ...	Ditto	28th February 1920	Ditto ...	98	225	824	1,893			Patchy near trees, otherwise uniform, badly rusted, height 3¼ feet.
B/9 575	Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	123	320	1,035	2,693	Sohaga ... ... 6 Raja plough ... ... 1 Spring toothed harrow ... 4 Country plough ... 2 Wheat harrowing ... 4		Very even stand, height 3½ feet.
	S-A ...	Ditto	24th February 1920	Ditto ...	117	342	984	2,878			Regular all over, height 3½ feet.
	Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	131	330	1,102	2,777			Regular all over, height 3¾ feet.
	S-B ...	Ditto	22nd February 1920	Ditto ...	145	273	1,220	2,297			Regular, but poor along trees, height 4 feet.
	Punjab 14 ...	Ditto	23rd February 1920	Ditto ...	143	363	1,203	3,055			Regular, but poor along road side, height 3½ feet.
	Pusa 12 ...	Ditto	18th February 1920	15th April 1920 ...	184	311	1,548	2,617			Less leafy, less tillering, height 3¾ feet.
	Punjab 14 ...	Ditto	23rd February 1920	24th April 1920 ...	164	324	1,380	2,727			Good, uniform stand, height 4 feet.
	13-C ...	11th November 1919	19th February 1920	22nd April 1920 ...	111	303	1,167	3,188			Tall imposing look, height 3¾ feet.
	$NH_{30} \times P_4$ ...	Ditto	23rd February 1920	Ditto ...	111	189	1,167	1,988			Very good ear, height 3¼ seet.
	$NH_{188} \times P_4$	Ditto	28th February 1920	Ditto ...	96	400	1,010	4,208			Rather thin, height 3¼ feet.
B/11 460	$NH_{48} \times P_4$ ...	Ditto	Ditto	Ditto ...	106	246	1,115	2,588	Sohaga ... ... 6 Raja plough ... ... 1 Spring toothed harrow ... 4 Country plough ... 2 Wheat harrowing ... 4		Ditto ditto.
	G_2 ...	Ditto	20th February 1920	Ditto ...	111	248	1,167	2,609			Early, good ear, height 3¼ feet.
	G_1 ...	Ditto	Ditto	Ditto ...	111	221	1,167	2,325			Ditto ditto.
	Cross 3 ...	Ditto	5th March 1920 ...	Ditto ...	117	227	1,231	2,388			Late, thick crop, height 3 feet.

Statement No. 4-A

SHOWING THE EFFECTS OF CULTIVATION ON WHEAT IN BARANI BLOCK (B).

Number of field and plot.	Area harvested in square yards.	Name of variety.	Cultivation.	Date of sowing.	Date of earing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
							Grain.	Straw.	Grain.	Straw.	
2/3	2/3 of 806	Punjab 14	Unharrowed	18th October 1919	23rd February 1920	13th April 1920 ...	346	762	2,076	4,572	
2/3		8-A	Ditto	Ditto	24th February 1920	Ditto ...	322	781	1,932	4,686	
2/4		Punjab 14	Harrowed	Ditto	23rd February 1920	Ditto ...	279	793	1,674	4,758	
2/4		8-A	Ditto	Ditto	24th February 1920	Ditto ...	318	750	1,908	4,500	
2/5		Punjab 14	Unharrowed	Ditto	23rd February 1920	Ditto ...	314	687	1,884	4,122	
2/5		8-A	Ditto	Ditto	24th February 1920	Ditto ...	291	664	1,746	3,984	
2/6		Punjab 14	Harrowed	Ditto	23rd February 1920	Ditto ...	297	629	1,782	3,774	
2/6		8-A	Ditto	Ditto	24th February 1920	Ditto ...	342	617	2,052	3,702	
2/7		Punjab 14	Unharrowed	Ditto	23rd February 1920	Ditto ...	295	658	1,770	3,948	
2/7		8-A	Ditto	Ditto	24th February 1920	Ditto ...	320	637	1,920	3,822	
2		Punjab 14	Harrowed	Ditto	23rd February 1920	Ditto ...	285	631	1,710	3,786	

2/8	806 2/8	8-A	Ditto	Ditto	24th February 1920	Ditto ...	273	572	1,638	3,433
2/9		Punjab 14	Sabul plough	Ditto	23rd February 1920	Ditto ...	273	650	1,638	3,900
2/9		8-A	Ditto	Ditto	24th February 1920	Ditto ...	328	492	1,968	2,952
2/10		Punjab 14	Country plough... ...	Ditto	23rd February 1920	Ditto ...	275	594	1,650	3,564
2/10		8-A	Ditto	Ditto	24th February 1920	Ditto ...	318	500	1,908	3,000
2/11		Punjab 14	Sabul plough	Ditto	23rd February 1920	Ditto ...	289	557	1,734	3,342
2/11		8-A	Ditto	Ditto	24th February 1920	Ditto ...	338	547	2,028	3,282
2/12		Punjab 14	Country plough	Ditto	23rd February 1920	Ditto ...	275	521	1,650	3,126
2/12		8-A	Ditto	Ditto	24th February 1920	Ditto ...	318	529	1,908	3,174
2/13		Punjab 14	Sabul plough	Ditto	23rd February 1920	Ditto ...	283	539	1,698	3,234
2/13		8-A	Ditto	Ditto	24th February 1920	Ditto ...	311	553	1,866	3,318
2/14		Punjab 14	Country plough... ...	Ditto	23rd February 1920	Ditto ...	242	537	1,452	3,222
2/14		8-A	Ditto	Ditto	24th February 1920	Ditto ...	240	516	1,440	3,096
5/1 (B)	4,224	8-A	Raja plough	23rd October 1919	25th February 1920	25th April 1920 ..	1,339	2,243	1,534	3,570
5/3 (B)		8-A	Country plough... ...	Ditto	Ditto ...	Ditto ...	886	1,334	1,015	1,528
5/2 (B)		Pusa 12	Raja plough	Ditto	20th February 1920	15th April 1920 ...	1,136	1,609	1,301	1,843
5/4 (B)		Pusa 12	Country plough... ...	Ditto	Ditto	Ditto ...	697	963	798	1,103
C/3	2,000	Punjab 14	Farm method	19th October 1919	23rd February 1920	26th April 1920 ...	502	908	1,214	2,197
C/3		Punjab 14	Desi method	Ditto	Ditto	Ditto ...	410	742	992	1,795

Statement No. 4-B

SHOWING RESULTS OF PERMANENT WHEAT AND PERMANENT WHEAT AND GRAM PLOTS SINCE THEIR ESTABLISHMENT

Year.	Rainfall.	Field No.	Name of crop and variety.	Outturn per acre in lbs.	Remarks.
1913-14 ...	27·57	B-17	Wheat Pusa 12	1,804	Permanent wheat plot started for the 1st year.
1914-15 ...	54·10	B-17	Ditto	639	
1914-15 ...	54·10	B-18	Ditto	690	
1915-16 ...	17·88	B-17	Ditto	1,043	
1915-16 ...	17·88	B-18	Wheat Pusa 12 and gram ...	1,117	Gram added for the 1st year to make it permanent wheat and gram plot.
1916-17 ...	37·86	B-17	Wheat Pusa 12	940	
1916-17 ...	37·86	B-18	Wheat Pusa 12 and gram ...	710	
1917-18 ...	53·37	B-17	Wheat Pusa 12	874	
1917-18 ...	53·37	B-18	Wheat Pusa 12 and gram ...	392	
1918-19 ...	17·71	B-17	Wheat Pusa 12	1,324	
1918-19 ...	17·71	B-18	Wheat Pusa 12 and gram ...	1,316	
1919-20 ...	30·94	B-17	Wheat Pusa 12	1,003	Germination meagre, gaps dibbled afterwards.
1919-20 ...	30·94	B-18	Wheat Pusa 12 and gram ...	1,044	

Statement No. 5-A.

SHOWING THE EFFECT OF BONE MEAL AND SUPERPHOSPHATE ON WHEAT IN BARANI IN BLOCK B.

No. of field.	Area harvested in square yards.	Name of variety.	Treatment.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease per acre in lbs.		Price of grain Punjab 14= Rs. 4 10 0, 8A= Rs. 4 12 0 per maund.	Price of straw 1¼ maunds per rupee.	Total of column 8 and 9.	Price of manure.	Profit or loss.	Remarks.
				Grain.	Straw.	Grain.	Straw.	Grain.	Straw.						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
										Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
2	806⅔	Punjab 14 ...	Bone meal 5 cwt., per acre.	301	650	1,806	3,900	+144	+558	+8 2 0	+5 7 1	+13 9 1	30 0 0	−16 6 11	Raja plough ... 3
15	806⅔	8-A ...	Ditto	301	699	1,806	4,194	−102	+888	−5 14 6	+8 10 7	+2 12 1	30 0 0	−27 3 4	S. T. harrow ... 10
2	806⅔	Punjab 14 ...	No manure ...	277	557	1,662	3,342	...	...	...	...	...	...	...	Country plough ... 2
16	806⅔	8-A ...	Ditto ...	318	551	1,908	3,306	...	...	...	...	...	...	...	Sohaga ... 10
2	806⅔	Punjab 14 ...	Bone meal 5 cwt., P. A.	326	529	1,956	3,174	+432	−36	+24 5 10	−0 5 7	+24 0 3	30 0 0	−5 15 9	Wheat harrowing ... 5
17	806⅔	8-A ...	Ditto	350	496	2,100	2,976	+540	−36	+31 4 6	−0 5 7	+30 14 11	30 0 0	+0 14 11	
2	806⅔	Punjab 14 ...	No manure ...	254	535	1,524	3,210	...	...	...	...	...	...	...	
18	806⅔	8-A ...	Ditto ...	260	502	1,560	3,012	...	...	...	...	...	...	...	
2	806⅔	Punjab 14 ...	Bone meal 5 cwt., P. A.	303	64	1,818	3,666	+144	+516	+8 2 0	+5 0 7	+13 2 7	30 0 0	−16 13 5	
19	806⅔	8-A ...	Ditto	326	629	1,956	3,774	+306	+714	+17 11 7	+6 15 5	+24 11 0	30 0 0	−5 5 0	
2	806⅔	Punjab 14 ...	No manure ...	279	525	1,674	3,150	...	...	...	...	...	...	...	
20	806⅔	8-A ...	Ditto ...	275	510	1,650	3,060	...	...	...	...	...	...	...	
2	806⅔	Punjab 14 ...	Superphosphate 1½ cwt., P. A.	283	510	1,698	3,060	+396	+246	+22 5 4	+2 6 5	+24 11 9	10 13 3	+13 14 6	
21	806⅔	8-A ...	Ditto	268	535	1,608	3,210	+108	+432	+6 4 1	+4 3 5	+10 7 6	10 13 3	−0 5 9	
2	806⅔	Punjab 14 ...	No manure ...	217	469	1,302	2,814	...	...	...	...	...	...	...	
22	806⅔	8-A ...	Ditto ...	250	463	1,500	2,778	...	...	...	...	...	...	...	
2	806⅔	Punjab 14 ...	Superphosphate, 1½ cwt., P. A.	301	574	1,806	3,444	+318	+420	+17 15 0	+4 1 7	+22 0 6	10 13 3	+11 3 3	
23	806⅔	8-A ...	Ditto	258	443	1,548	2,658	−102	−342	−5 14 6	−3 5 5	−9 3 11	10 13 3	−20 1 2	
2	806⅔	Punjab 14 ...	No manure ...	248	504	1,488	3,024	...	...	...	...	...	...	...	
24	806⅔	8-A ...	Ditto ...	275	500	1,650	3,000	...	...	...	...	...	...	...	

STATEMENT No. 5-B (BLOCK B)

SHOWING RESULTS OF BONE MEAL AND SUPERPHOSPHATE IN CONJUNCTION WITH AMMONIUM SULPHATE IN THE BARANI WHEAT.

1	2	3	4	5		6		7		8	9	10	11	12	13
No. of field and plot.	Area harvested in square yards.	Treatment.	Variety.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease in lbs. from manured plot.		Price of difference of grain in column 7 @ Rs. 4-12-0 per maund.	Price of difference of straw in column 7 @ 1½ maunds per rupee.	Total of columns 8 and 9.	Price of manure.	Profit or loss.	Remarks.
				Grain.	Straw.	Grain.	Straw.								
										Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
12-14 / 1	752	Control ...	Pusa No. 12.	119	189	765·8	1,216	...	...	...	...	...	...	...	
12-14 / 2		Ammonium Sulphate ...		129	203	830·3	1,306	+64·5	+90	+3 11 9	+0 14 1	+4 9 10	25 7 4	—20 13 6	
12-14 / 3		Ammonium Sulphate + Superphosphate 15 lbs. P_2O_5. per acre.		145	240	933·2	1544·6	+167·5	+328·6	+9 11 3	+3 3 3	+12 14 6	28 13 1	—15 14 7	
12-14 / 4		Ammonium Sulphate + Bone meal 15 lbs. P_2O_5. per acre.		164	246	1,055	1,583	+289·2	+367	+16 12 0	+3 9 7	+20 5 7	28 12 9	—8 7 2	
12-14 / 5		Control ...		135	207	868·8	1,332	...	...	...	...	...	...	...	
12-14 / 6		Ammonium Sulphate ...		152	234	978·1	1,506	+109·3	+174	+6 5 4	+1 11 3	+8 0 7	25 7 4	—17 6 9	
12-14 / 7		Ammonium Sulphate + Superphosphate 15 lbs. P_2O_5. per acre.		156	238	1,004	1531·8	+135·2	+199·8	+7 13 4	+1 15 4	+9 12 8	28 13 1	—19 0 5	
12-14 / 8		Ammonium Sulphate + Bone meal 15 lbs. P_2O_5. per acre.		143	231	920·2	1,422	+51·4	+90	+2 15 8	+0 14 1	+3 13 9	28 12 9	—24 15 0	
12-14 / 9		Control.		117	182	753	1,171	...	...	...	...	...	...	...	
12-14 / 10		Ammonium Sulphate ..		137	211	881·5	1,358	+128·5	+187	+7 7 1	+1 13 4	+9 4 5	25 7 4	—16 2 11	
12-14 / 11		Ammonium Sulphate + Superphosphate 15 lbs. P_2O_5. per acre.		211	324	1,358	2085·3	+605	+914	+35 4 2	+8 15 4	+44 13 6	28 13 1	+15 6 5	
12-14 / 12		Ammonium Sulphate + Bone meal 15 lbs. P_2O_5. per acre.		243	375	1,596	2,418	+843	+1,242	+48 13 4	+12 2 10	+61 0 2	28 12 9	+32 3 5	

Statement No. 5-C

SHOWING THE RESULTS OF GAURA *VERSUS* FALLOW IN BLOCK B BARANI.

No. of field.	Area harvested in square yards.	Name of variety.	Treatment.	Actual outturn in lbs. Grain.	Actual outturn in lbs. Straw.	Outturn per acre in lbs. Grain.	Outturn per acre in lbs. Straw.	Remarks.
2/25	806 2/3	Punjab 14	Gaura removed during kharif	205	393	1,230	2,358	
2/25		8-A	Ditto	176	309	1,056	1,854	
2/26		Punjab 14	Fallow in kharif	285	633	1,710	3,798	
2/26		8-A	Ditto	322	623	1,932	3,738	
2/27		Punjab 14	Gaura ploughed in in kharif	307	642	1,842	3,852	
2/27		8-A	Ditto	303	549	1,818	3,294	
2/28		Punjab 14	Fallow in kharif	314	553	1,884	3,318	
2/28		8-A	Ditto	291	605	1,746	3,630	
2/29		Punjab 14	Gaura removed	238	434	1,428	2,604	
2/29		8-A	Ditto	227	379	1,362	2,274	
2/30	755	Punjab 14	Fallow in kharif	266	549	1,705	3,519·4	
2/30		8-A	Ditto	266	551	1,705	3,532·2	

STATEMENT No. 5-D

SHOWING THE RESULT OF RESIDUAL EFFECT OF BONE MEAL AND SUPERPHOSPHATE IN CONJUNCTION WITH GREEN MANURE IN CHAHI.

1	2	3	4	5		6		7		8	9	10	11	12	13
				Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease in lbs. per acre.							
No. of field.	Name of variety.	Area harvested in square yards.	Treatment.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Price of grain of column 7 at Rs. 4-12-0 per 82 lbs.	Price of straw of column 7 at 102 lbs. per rupee.	Total of columns 8 and 9.	Previous profit or loss.	Profit or loss per acre.	Remarks.
										Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
A 10	8-A ...	378	Unmanured	140	330	1,792·5	4,225	...	...	..	...	...	...	...	Country plough ... 4 S. T. harrow ... 1 Sohaga ... 5 Wheat harrowing ... 4 Date of sowing—20th October 1919. Date of harvesting.— Pusa 12 on 15th April 1920. 8-A on 24th April 1920.
	Pusa 12 ...		Ditto	115	272	1,472	3,482·8	...	...	...	...	...	...	...	
	8-A ...		Green manured	117	231	1.498	2,957.7	...	...	...	...	...	...	...	
	Pusa 12 ...		Ditto	119	199	1,523·7	2,548	...	...	...	...	...	...	...	
	8-A ...		Green manured + Superphosphate at 20·76 lbs. P_2O_5. per acre.	129	216	1,651·7	2,765·7	+153	—192	+8 13 10	—1 14 1	+6 15 9	—28 1 6	—21 1 9	
	Pusa 12 ...		Ditto	106	144	1,357	1,843·7	—166·7	—704·3	—9 10 6	—6 14 6	—16 9 0	—3 13 3	—20 6 3	
	8-A ...		Green manured + bone meal at 20·76 lbs. P_2O_5. per acre.	96	202	1,229	2,586·6	—269	—371·1	—15 9 4	—3 10 3	—19 3 7	—47 2 1	—66 5 8	
	Pusa 12 ...		Ditto	92	134	1,177·9	1,715·7	—345·8	—832·3	—20 0 6	—8 2 6	—28 3 0	—6 9 8	—34 12 8	
	8-A ...		Green manured ...	90	216	1,152	2,765·7	...	...	...	...	...	...	...	
	Pusa 12 ...		Ditto	74	134	947·5	1,715·8	...	...	..	...	...	...	...	
	8-A ...		Green manured + Superphosphate at 20·76 lbs. P_2O_5. per acre.	108	152	1,382·8	1,946	+230·8	—819·7	+13 5 11	—8 0 7	+5 5 4	—42 11 1	—37 5 9	
	Pusa 12 ...		Ditto	74	114	947 3	1,459·7	—·2	—256·1	—0 0 2	—2 8 2	—2 8 4	—36 13 7	—39 5 11	
	8-A ...		Green manured + bone meal at 20·76 lbs. P_2O_5. per acre.	119	178	1,523·7	2,279	+371·7	—486·7	—21 8 6	—4 12 4	+16 12 2	—36 11 11	—19 15 9	
	Pusa 12 ...		Ditto	98	146	1,254·3	1,869	+306·5	+153·2	+17 12 1	+1 8 0	+19 4 1	—33 3 3	—13 15 2	

Statement No. 5-E.

SHOWING THE RESIDUAL EFFECT OF VARIOUS MANURES ON WHEAT.

1	2	3	4	5		6		7		8	9	10	11	12	13
No. of field.	Name of variety.	Area harvested in square yards.	Treatment.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease per annum in lbs.		Price of grain at Rs. 4-12-0 per 82 lbs.	Price of straw .02 lbs. per rupee.	Total of columns 8 + 9.	Previous profit or loss.	Profit or loss.	Remarks.
				Grain.	Straw.	Grain.	Straw.	Grain.	Straw.						
										Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
			Unmanured	387	775	1,758·9	3,582·6	...	...	...	...	...	...	...	Date of sowing 3rd November 1919. Date of harvesting 26th April 1920. Rajah plough = 3 Country plough = 6 S. T. harrow = 7 Sohaga = 4 Wheat harrowing = 3 Irrigation = 1 on 28th March 1920 beside one for sowing.
			Lime 2,000 lbs. + Am. Sulp. 200 lbs. per acre.	422	830	1,953·7	3,836·8	+162·7	+254·2	+9 6 10	+2 7 10	+11 14 8	+6 15 7	+18 14 3	
			Unmanured	468	781	2,163	3,610·3	...	...	...	...	...	...	...	
			Potassium Sulp. 200 lbs. per acre + Super. 200 lbs. per acre.	346	674	1,599·4	3,115·7	— 563·6	— 494·6	— 32 10 4	— 4 13 7	— 37 7 11	— 35 14 11	— 73 6 10	
			Lime 2,000 lbs. + Am. Sulp. 200 lbs. + Potassium 200 lbs. + Super. 200 lbs. per acre.	344	738	1,590·2	3,412	— 572·8	— 198·3	— 33 2 11	— 1 15 1	— 35 2 0	— 96 15 0	— 132 1 0	
			Potassium Sulp. 200 lbs. + Super. 200 lbs. per acre.	377	656	1,742·7	3,032·5	— 420·3	— 577·8	— 24 5 8	— 5 10 8	— 30 0 4	— 104 10 5	— 134 10 9	
			Unmanured	379	895	1,752	4,091	...	...	...	...	...	...	...	
			Lime 2,000 lbs. + Am. Sulp. 200 lbs. per acre.	365	865	1687·2	3,998	— 64·8	— 92·4	— 3 12 1	— 0 14 6	— 4 10 7	— 65 4 6	— 69 15 1	
	8-A	1,047	Unmanured	402	836	1,858	3,864·6	...	...	...	...	...	...	...	
			Do.	394	627	1,821·3	2,898·4	...	...	...	...	...	...	...	
			Lime 2,000 lbs. per acre + Super. 200 lbs.	357	594	1,696	2,745·9	— 124·8	— 152·5	— 7 3 8	— 1 7 11	— 8 11 7	— 41 1 7	49 13 2	
			Unmanured	447	701	2,066	3,240·5	...	...	...	...	...	...	...	
			Potassium Sulp. 200 lbs + Am. Sulp. 200 lbs. per acre.	367	529	1,696	2,445·4	— 370	— 795·1	— 21 6 11	— 7 12 9	— 29 3 8	— 34 3 9	— 63 7 5	
			Lime 2,000 lbs. + Super 200 lbs. + Am. Sulp. 200 lbs. + Potassium Sulp. 200 per acre.	412	574	1,904·6	2,653·4	— 162	— 587·1	— 9 6 2	— 5 12 1	— 15 2 3	— 68 7 9	— 83 10 0	
			Potassium Sulp. 200 lbs. + Am. Sulp. 200 lbs. per acre.	385	810	1,779·8	3,743·5	— 286·2	+ 503	— 16 9 3	+ 4 14 11	— 11 10 4	— 4 9 2	— 16 3 6	
			Unmanured	441	783	2,038	3,619·6	...	...	...	...	...	...	...	
			Lime 2,000 lbs. + Super. 200 lbs. per acre.	414	779	1,913·8	3,601·1	— 124·2	— 18·5	— 7 3 1	— 0 2 11	— 7 6 0	— 53 4 11	— 60 10 11	
			Unmanured	410	838	1,894·9	3,873·8	...	...	...	...	...	...	...	

Statement No. 6.

EFFECT OF SODIUM NITRATE ON POTATOES.

1	2	3	4	5	6	7	8	9	10	11
Field No.	Crop.	Area harvested in square yards.	Treatment.	Actual outturn in lbs.	Outturn per acre in lbs.	Increase or decrease per acre in lbs.	Money value of column 7 at Rs. 3-12-0 per 82 lbs. of potatoes.	Price of manure.	Profit or loss per acre.	Remarks.
							Rs. A. P.	Rs. A. P.	Rs. A. P.	
A 13	Potatoes.	904½	No manure ...	1,421	7,601·7	...	...	...	...	Date of sowing—2nd October 1919. Date of harvesting—28th January 1920. All the four bits received 32 maunds of castor cake per acre. No manure bit therefore shows want of Soda Nitrate only.
		258·5	Sodium Nitrate at 1 maund per acre.	301	5,635·7	—1,966	—89 14 6	16 13 5	—106 11 11	
		258·5	Sodium Nitrate at 2 maunds per acre.	361	6,759	—842·7	—38 8 7	33 10 10	—72 3 5	
		258·5	Sodium Nitrate at 3 maunds per acre.	451	8,444·2	+842·5	+38 8 5	50 8 3	—11 15 9	

Statement No. 7.

GRAM VARIETIES.

No. of field.	Are harvested in square yards.	Name of variety.	Actual outturn in lbs.	Outturn per acre in lbs.	Remarks.
C 3·4	5,369	Local	902	813	Raja plough 2. Country plough 1. S. T. Harrow 4. Sohaga 4. Date of sowing 19th September 1919. Date of harvesting—15th April 1920.
	1,756	Register No. 7	369	1,017	
	1,756	Do. No. 15	360	992	
	1,756	Do. No. 17	426	1,174	
	1,756	Do. No. 20	348	959	
	826	Small Kabli	123	720	
	826	Large „	65	380·8	

Annual Report of the Sargodha Seed Farm for the year 1919-20.

Introductory.—I took over charge of the farm from M. Fateh-ud-Din on the afternoon of 6th April 1920, so that it has been under my supervision only for the last three months of the year under report.

General.—This farm has been under our direct control since 1913, but no experimental work was possible until 1916-17 in which year a part was laid out for test of various varieties of wheats and cottons. This, therefore, is the completion of third year of the experimental work of some importance. For detailed history of the farm please see reports for 1917-18 and 1918-19. At the time when the Department started direct cultivation on a part of the farm in 1916-17 the fields were in Killas of varying qualities of the soil, but to enable experiments to be carried on it was important to have strips of land of as uniform a texture as possible. Therefore Killas were broken into long regular plots, which necessitated a good deal of levelling, and in doing so the quality of the soil was temporarily impaired and consequently the uniformity was lost. For this reason the results of the experiments carried out so far cannot be considered as final or by any means reliable. However during the short time since the change was made a good deal of improvement has been made and the results of the year under report, though not quite conclusive, may be looked upon as progressive and hopeful.

Rainfall.—Rainfall should not be of much consideration in the canal-irrigated tracts, but in the Lower Jhelum Colony the canal closures, which are frequent and untimely, necessitate good and well-distributed rains, and whenever they come they are quite welcome.

The following table gives the rainfall for the last two years :—

		1918-19.	1919-20.
July	... ...	1·90″	3·03″
August	... ...	1·77″	4·40″
September	... ...	·82″	*Nil.*
October	... ...	0·05″	*Nil.*
November	... ...	*Nil*	*Nil.*
December	... ...	·28″	1·03″
January	... ...	·89″	·25″
February	... ...	·03″	·65″
March	... ...	*Nil*	·98″
April	... ...	·44″	·06″
May	... ...	·64″	·81″
June	... ...	*Nil*	·09″
	Total ...	6·82″	11·30″

There was 4·48″ of rain more than the last year, and, with the exception of the showers in April and May, the distribution was satisfactory and it did a lot of good to standing Rabi crops. But the rain in the month of April rather delayed the wheat harvest, and those in May did a good deal of damage to cut wheat and discoloured threshed grains. These showers delayed threshing operations which were completed only in the beginning of June. The remaining quantity of rain did a lot of good and was well distributed with the result that despite delayed harvest under rather unfavourable circumstances we have had a bumper Rabi crop. The 1·03″ rain at the end of December was most opportune, as it enabled all cotton stubbles to be broken up on the farm as they were left unbroken on account of reduction of canal water-supply since October last. Similarly the showers in January, February, and March did an immense amount of good to the rabi; and without this we should never have got the heavy yield of this rabi as the water-supply was so very much reduced.

Experimental.—The following experiments were carried out on the farm :—

(1) Wheat varietal tests.

(2) Mr. Howard's wheat tests.

(3) Comparative tests of Desi and American cottons.

(4) Spacing experiments with 4-F cotton.

(5) Water-saving experiments with wheat and Toria.

(6) Economic Botanist's gram varieties.

(7) Juar varietal tests.

(8) Local and French oats as fodder crops.

Wheats.—(1) Wheat varietal tests (Statements 13 and 14). Following types were tested with 8-A as the standard wheat :—

8-B.

C-13 (Cawnpore 13).

Punjab 11.

9-C.

17-B.

Punjab 14.

Pusa 12.

Of these 8-A, 8-B, Punjab 11, 9-C, 17-B and Punjab 14 are Punjab wheats while C-13 was imported from Cawnpore and Pusa 12 from Pusa, Behar. The tests were made in two sets :— One was early sown (dates of sowing 26th-27th October) and the other late (date of sowing 7th November). The difference between the two sowings being 11 days. The early sown plots were preceded by cotton, and the late sown by wheat so that the former had ten months summer fallow, while the latter could only get 5¼ months. Results shown in Statement 14 show that 8-A is the best wheat except Pusa 12 which for several reasons is not likely to be a popular wheat in the colonies, but as has already been stated in the opening paragraph of the report the plots are rather uneven in character which accounts for difference in yields of 8-A in various strips.

8-*A* versus *Punjab* 11.—(Statement No. 14) plot under Punjab 11 gave 1,689 lbs., while the plots on its either side under 8-A gave 1,677 lbs. and 2048·5 lbs., respectively. This shows an increase of 11lbs. in favour of Punjab 11 when compared with the first plot under 8-A but a decrease of 357lbs. when compared with the second one. If an average of the two plots under 8-A is taken then it beats Punjab 11 by 173lbs. per acre.

(Statement 13) ; here also 8-A beats Punjab 11 by 18lbs. per acre. Similarly when 8-A is compared with other wheats keeping the variable nature of plots in mind it stands its test well.

Of course owing to short interval of time during which these tests have been carried out and owing to unevenness of soil textures the results cannot be considered as final and tests will have to be carried out for several years to come to get at conclusive results.

Following is the order of merit for all wheats taking the average of both early and late sown crops :—

Wheat.	*Yield per acre.*
Pusa 12	2240·7 lbs.
8-A	2054·8 „
8-B	2029·8 „
Punjab 14	1928·5 „
17-B	1799 „
Punjab 11	1738 „
9-C	1675·7 „
C-13	1585·4 „

Although Pusa 12 stands first as far as its yield is concerned yet owing to its several well-known defects it can never be a popular colony wheat. It may also be mentioned he that the weather conditions for this rabi were ideal except at the time of harvest and the condition of the crops on all the plots was uncommonly good.

(2) *Howard's wheats* (*Statement* 11).—Besides the other wheats tried on the farm seeds of $NH_{53} \times P_4$ and $NH_{98} \times P_4$ received from Mr. Howard were sown on 16th of December. As the seed was received late there was no room left on the direct area for their trial and therefore they had to be sown on the tenants. Although the soil under each type was of similar character, and the number of ploughings and waterings was the same, the plots differed in amount of manure already applied. The plot under $NH_{98} \times P_4$ had received 200 maunds of farmyard, but the second had received 150 maunds only, that is, the first plot had 50 maunds more dung. $NH_{53} \times P_4$ gave a produce of 1,506lbs. per acre and $NH_{98} \times P_4$ gave 1,870lbs., *i.e.*, the latter gave an increase of 364 lbs. per acre. Both of these wheats are beardless and seem to stand very well and their further trials will be carried out next year.

Cottons.—(1) *Comparative tests of Desi and American cottons* (*Statement Nos.* 9 *and* 10).—There were six varieties under trial in duplicate sets ; three were Americans (285 F, 280 F, and 4 F) and three Desi (Khanna, 22 Mollisoni and 40 Rosea). All the Americans are Economic Botanist's selections and so are 40 Rosea and 22 Mollisoni out of the Desis. The Khanna is a mixture of nearly all indigenous varieties and is largely grown in Ludhiana District. It has a good yield and the lint is fairly long.

As regards yields 40 Rosea with 1897·6lbs. per acre tops the list, with Khanna 1748·5lbs. coming next and 22 Mollisoni with 1,490lbs. standing third. 280 F, 417lbs., 285 F, 368lbs. and 4 F, 165·5lbs. come last. Looking at these figures one cannot help thinking that something abnormal must have been the limiting factor for the American cottons. The season was most favourable for all cottons up to October, when suddenly the plants, chiefly Americans and particularly 4 F, began to turn crimson and shed their leaves. This was due to several causes discussed in the report on district work.

Desi cottons were also affected to a more or less extent during this time but their fruiting was not reduced to the same extant as that of the Americans. This I think account for the poor yields of American cottons in general and 4 F. in particular this year and therefore need no further discussion. These same varietal tests will be repeated next year.

(2) *Spacing experiment with 4 F cotton.*—(*Statements Nos. 7 and* 8).—Advantage of sowing cottons in lines is well known and it is necessary to find out the most appropriate distance between each row to give the highest yield per acre. With this view in mind this experiment was started with American cotton 4 F only and was arranged in a duplicate set with varying distances of three, four, and five feet between the rows. As the year was extremely favourable in the beginning the plants soon covered up the space and promised to give definite results. But the sudden set-back after October vitiated all results which, though interesting and instructive, are by no means definite. In each set of the experiment the plot with rows 5 feet apart yielded highest with 281lbs. of cotton per acre ; 3 feet apart comes second with 189·2 lbs. per acre and 4 feet apart is the last with 166·6 lbs. of kapas per acre.

These results are rather peculiar as 3 feet apart coming in between the two appears to be out of place and against all expectation. However in spite of the abnormal year towards the end it definitely points out to the fact that the yield is highest at the distance of 5 feet between the rows for 4 F. The experiment will be repeated next year.

Water saving experiment with Wheat and Toria.—(*Statement Nos. 3, 4, and 5, 6*).—This experiment was started on this farm in rabi 1917-18 on the recommendation of Mr. Howard with the object of finding out the water requirements of wheat and incidentally to ascertain the extent to which the clamour for water in the colonies is true. The exact procedure to be adopted and the variety of wheat to be tested as summed up by Mr. Howard himself have been fully described in the last two reports and need no repetition here.

One can safely assume to get a fairly good crop in a normal year with only two irrigations, but the desire for water amongst the zamindars is so great that they will irrigate wheat whenever they can get water regardless of whether crop stands in need of it or not. Such injudicial and haphazard methods of irrigation do not only do no good to the crop, but may actually reduce the outturn. This experiment will prove two points—

(*a*) The number of waterings to give highest yield per acre;

(*b*) The proper time for irrigation.

Number (*b*) is an extremely important point to decide because wheat requires irrigation in spring. (February and March) when growth starts afresh and is very rapid and it seems that unless water is applied during these months no other irrigation can serve its purpose satisfactorily, that is watering in January or in April seems to have very little effect in stimulating the growth or increasing the yield of grains. This experiment on wheat has been conducted for the last four years. Similar experiments are being carried out at Lyallpur, too. It is arranged in duplicate sets with no water, 1, 2 and 3 irrigations after sowing. Unfortunately owing to canal vagaries the sowing of wheat was delayed and could only be done in the latter half of December instead of October and November. This delay was undoubtedly in favour of the " no water " plot, as it had comparatively smaller period to go through before harvest and its requirement for irrigation could not be judged fully. Along with this the rain in December, January February, and March have to some extent equalized results of no water or one and two water plots. However, the results obtained during this and the last two years point to the fact that good cultivation can replace irrigations and the proverb " cultivation is irrigation" is endorsed. Looking at the figures (Statements Nos. 3 and 4) it is clear that increased number of waterings does give increased yield (exceptions should be made with the " no water" plot in Statement No. 4-E. This plot shows a high yield, but as the fields as a whole are not of uniform texture, and a comparatively uniform and very rich piece of land fell to its lot ; hence the increased yield). This increase of outturn is more marked in bhusa than in grains and this tends to show that extra irrigation stimulates the vegetative growth.

Taking the average yield of all plots and neglecting the comparatively rich or poor condition of the soil the following are the yields per acre and their order of merit :—

(*a*) 1203·4 lbs. with no irrigation.

(*b*) 1,551 „ „ 3 „

(*c*) 1,199·3 „ „ 2 „

(*d*) 1,018·3 „ „ 1 „

The fact that plots were sown late coupled with rains during winter and spring and the unevenness of the texture of plots renders the results unreliable and therefore the experiment will be repeated.

This experiment with toria is of particular interest, and though there is some doubt as to what is to be done with water thus saved from wheat, there is no apparent difficulty in utilizing water saved from toria. Toria is sown at the end of August or beginning of September and is given two or even three irrigations before harvest in January. If water can be spared it can be utilized most efficiently in irrigating American cottons and for the early sowing of wheats. It is most important that American cottons should receive last irrigation in September or October and therefore the importance of water saved from toria is easily understood. The water saving experiment with toria was started last year, when two plots with " no watering " and " one watering " were arranged. The results were very encouraging, " one watering " having given only 98lbs. per acre more than " no watering " crop. This year 4 plots were arranged with " no water," " one, two and three waterings," and the results are in favour of the first two.

" No watering " after sowing has given 732·3lbs. per acre against 617lbs. per acre which is the average of the colony where two or three irrigations are generally applied. The plot with one watering gave 950·4lbs. per acre, *i.e.*, one watering has increased the outturn by 218lbs. per acre. Statements Nos. 5 and 6 show that more than one irrigation to this crop is not only a waste but actually reduces the yield.

These results will be confirmed next year.

Economic Botanists gram varieties.—(*Statement Nos.* 1 *and* 2).—This experiment was started with the object of testing various varieties of grams selected by the Economic Botanist against the local variety. The crops were sown in direct area as well as with the tenants whose soils were rather poor and irregular in texture. But results obtained on the area under direct cultivation are good and quite reliable (Statement No. 1). Both areas where sown with canal irrigation but received no irrigation afterwards. In fact, they did not stand in any need as the rains were well distributed throughout winter and the spring.

Economic Botanist No. 20 stands first with 2,176·4lbs. per acre as against 822·8 to 987·4lbs. the average yield per acre of the colony. Even the lowest yielding plot under the local variety has given 1,279·5lbs. per acre. These markedly increased yields are due to two reasons :—

(*i*) Good cultivation.

(*ii*) Land under the trial lay fallow for 9 months after a crop of cotton.

Taking the average of both acres they stand as follows :—

(*i*) Economic Botanist No. 20, 2,176·4 lbs.

(*ii*) „ „ Nos. 15 and 7, 1,791·7 lbs.

(*iii*) Local, 1779 lbs.

(*iv*) Economic Botanist, No. 17, 1,629·2 lbs.

Fodders.—Oats and Juar—This colony being mainly a horse-breeding tract requires more attention to grow and improve fodder crops then hitherto it has received. Besides brood mares the zamindars are very fond of cattle and rear them in exceedingly large numbers, and, as the prices of ghee have still a tendency to rise, the number of milch cattle is not likely to decrease or rather to the contrary may go up ; therefore, the need for production of fodder in plentitude is more than ever emphasized.

Oats.—A test was made between the local and French oats. The seed was very kindly supplied by Major Mayne of Sargodha Depôt and both our farm as well as the Depôt are carrying out the test. Two bits with French oats and two with local were sown on the first of November 1919 and again one bit under French and one with the local on 7th November. Unfortunately the canal closures interfered with the thorough test of these two fodders and though 3 irrigations were required for the local type no less than six were wanted for the French. Detailed outturns are given in Statement No. 12, but the average yields per acre for each are as follows :—

	Grain.	*Bhusa.*
French, 1919-20	534 lbs.	7,359 lbs.
Local, 1919-20	1,771 „	4,262·1 „
French, 1918-19	3,224·7 „	10,902 „
Local, 1918-19	2,616·3 „	8,990 „

These results in both tests favour the French oats as a fodder crop, the leave of the French oats are big and broad and the stand very good, yielding a heavy, bulky and nutritious fodder.

CONTOUR MAP OF THE AREA UNDER COTTON IN DIRECT CULTIVATION AREA. THE BROWN COLOURED PLACES SHOW THE GAPS BEARING NO PLANTS.

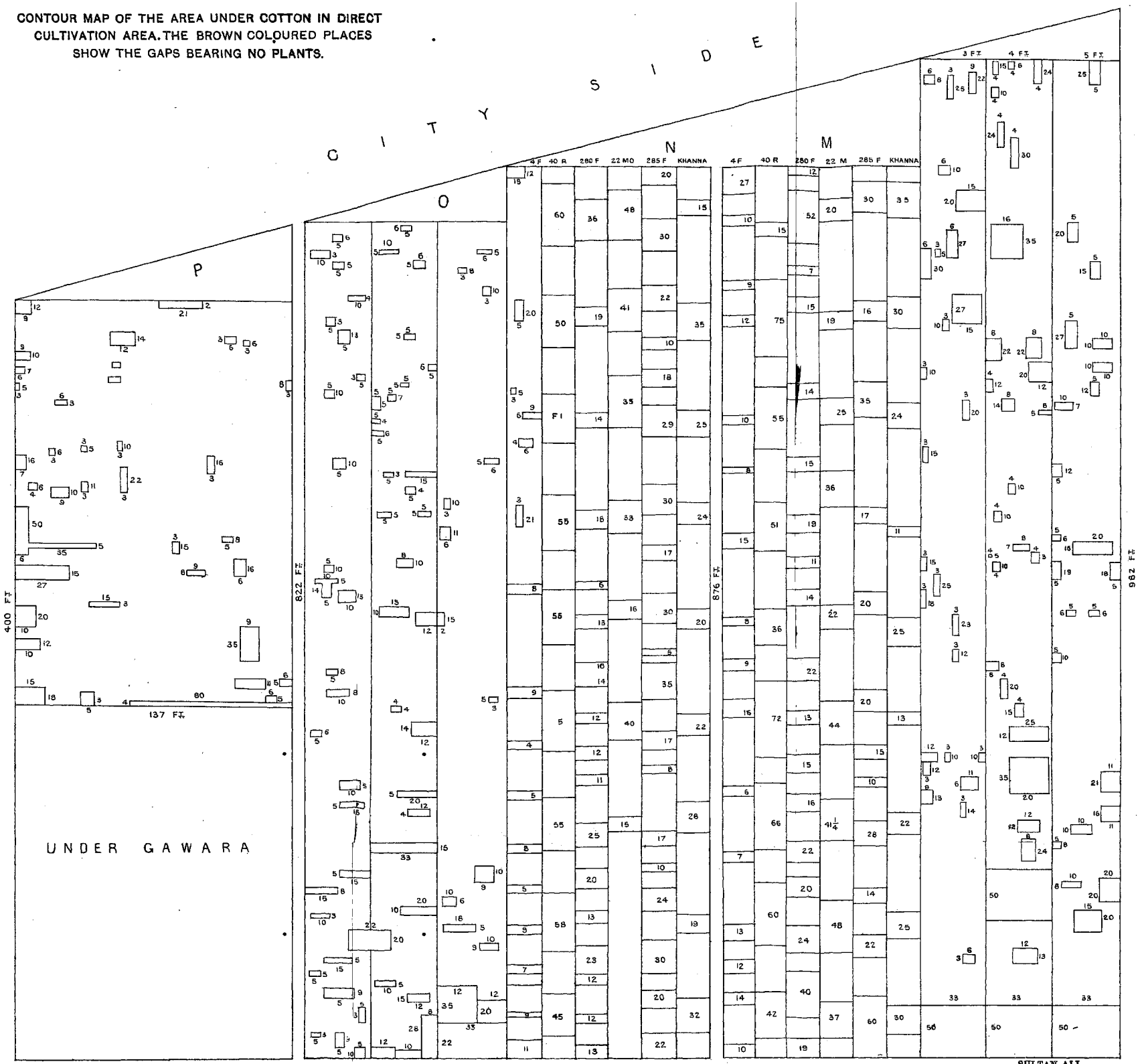
CITY SIDE
CITY GRAVE YARD
AREA UNDER DIRECT CULTIVATION
400 FT.
822 FT.
876 FT.
982 FT.
137 FT.
UNDER GAWARA
4 F 40 R 280 F 22 MO 285 F KHANNA
4 F 40 R 280 F 22 M 285 F KHANNA
3 FT. 4 FT. 5 FT.
MAIN WATER COURSE

Photo.-Mechl. and Litho. Dept., Thomason College, Roorkee. October, 1920.—No.1520.520.

SULTAN ALI,
Deputy Director of Agriculture,
1st Circle, Punjab Gurdaspur.

The greatest advantage of the French oats is that it remains green for a much longer period and supplies green fodder in April and May when there is a general scarcity of other fodders and no green fodders can be had. If water supply is sufficient the French oats will give at least twice as much bulky green fodder as the local; furthermore, it is very nutritious and much relished by all sorts of cattle. As feared there was some difficulty in getting this crop to come to seed, but last year some little seed was obtained, though poor in its germination capacity. It remains to be seen if the plants will acclimatize and begin to bear good seed, but I am afraid for the next few years the seed will have to be imported fresh every year.

Juar.—Three varieties were under trial—the Imphy, Akola, and Taunsa.

Seed of Imphy Juar was obtained from Risala No. 22. It is an American variety. Taunsa Juar seed came from Dera Ghazi Khan. It is a very sweet variety and the cattle relish on it, and will be given wider trials next year.

Akola juar seed was obtained from Akola farm in the Central Provinces in 1917 and was first grown in the farm in 1918. It was kept standing up to the beginning of January 1919, hoping that the plant would soon come to seed. It grew very tall and gave an excellent sweet fodder, but unhappily it practically failed to give any appreciable amount of seed. A few seeds that we did get were unfortunately quite immature and undeveloped with only three to four per cent. germination capacity. This seed was again sown during the year under report, but has failed to give any crop. This juar, though an excellent fodder, has to be acclimatized and therefore the seed will have to be imported afresh.

Summary.—It is well to describe the outcome of the experiments carried out during the year:—

(I).—8-A is the best wheat and will be distributed on a large scale next year.

(II).—This year was exceptionally bad for all cottons, especially Americans and particularly 4-F. For reasons of their failure see district report.

(III).—American cottons should be sown in lines about 5 feet apart on a good soil.

(IV).—Increased number of waterings gives increased yield, but this increase is more marked in bhusa than in grains. Right number of irrigations is still to be found out.

(V).—Water could be saved from Toria and could be most beneficially used for irrigating cottons and sowing wheat early.

(VI).—Fodder trials show superiority of French oats over the local type.

Tenants.—Half of the area of the farm is given to tenants who grow and multiply selected seeds, most of which is available for sale during the next year. Their presence on the farm is an extremely encouraging factor as zamindars visiting the farm immediately cast their conservatism aside and begin to follow the use of new implements and to grow the improved seeds.

Crop pests.—There was no serious pest on the farm, except Root Rot which was widely spread and was responsible for a fair amount of damage to cottons.

Income and Expenditure.—The total income from the sale of farm produce amounts to Rs. 7,692-10-6 and the expenditure during the year came to Rs. 2,747-15-7. This does not include the payment of the staff.

Visitors.—The farm is widely known and is now well frequented with visitors who come to purchase seed, see the work and to take advice in various Agricultural matters. His Honour the Lieutenant-Governor Sir Edward Maclagan was amongst the most distinguished visitors of this year.

Staff.—Qazi Sami Ullah has been in charge of the farm throughout the year and has done excellent work. His experience on the farm and the movement amongst the zamindars give him exceptional qualifications for the post of Manager and District Assistant.

Acknowledgments.—My special thanks are due to H. H. Jenkyns, Esq., I.C.S., the Deputy Commissioner of Shahpur. He has taken very keen interest in the progress of the farm and has done everything in furthering its reputation far and wide in the colony.

M. SULTAN ALI,

Deputy Director of Agriculture,

1st Circle, Gurdaspur.

The 18th July 1920.

Statement No. 1.

SHOWING THE RESULT OF ECONOMIC BOTANIST'S DIFFERENT GRAM VARIETIES TESTED AT THE SARGODHA SEED FARM DURING RABI 1919-20 (DIRECT CULTIVATION.)

No. of field.	Previous crop.	Name of variety.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual Outturn.						Outturn per acre.						Remarks.
						Grain.			*Straw.*			*Grain.*			*Straw.*			
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
A, B, C	Cotton ...	E. P. No. 20 ...	2nd October 1919	8th April 1920	389	2	5	0	3	16	0	26	18	0	42	12	0	The stubbles broken with the Raja plough on 20th February 1919. S. T. harrow on 22nd March 1919, 19th June 1919, and 21st August 1919. Desi plough on 16th August 1919 again S. T. harrow on 30th August 1919. Desi plough on 19th September 1919. Horse hoe on 28th September 1919. Field was watered on 26th September 1919 for sowing. Sohaga twice, Desi plough once, sohaga twice again on 1st October 1919.
		Local ...	Ditto	Ditto	389	1	39	0	4	0	0	24	23	0	49	31	0	
		E. B. No. 15 ...	Ditto	Ditto	389	1	30	0	4	0	0	21	31	0	49	31	0	
		Local ...	Ditto	Ditto	389	1	30	0	3	10	0	21	31	0	40	17	0	
		E. B. No. 7 ...	Ditto	Ditto	389	1	30	0	3	0	0	21	31	0	37	13	0	
		Local ...	Ditto	Ditto	389	1	39	0	3	20	0	24	23	0	43	22	0	
		E. B. No. 17 ...	Ditto	Ditto	389	1	23	0	3	19	0	19	24	0	43	9	0	
		Local ...	Ditto	Ditto	389	1	10	0	3	20	0	15	22	0	43	22	0	

Statement No. 2.

SHOWING THE RESULTS OF ECONOMIC BOTANIST'S DIFFERENT GRAM VARIETIES TESTED AT THE SARGODHA SEED FARM DURING RABI 1919-20 (TENANTS AREA.)

No. of field.	Previous crop.	Name of variety.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual Outturn.						Outturn per acre.						Remarks.
						Grain.			*Straw.*			*Grain.*			*Straw.*			
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
Square No. 58	Moth ...	E. B. No. 20 ...	1st October 1919	10th April 1920	635	1	5	0	2	4	0	8	23	0	16	0	0	
		Local ...	Ditto	Ditto	635	1	35	0	2	16	0	14	12	0	18	12	0	
		E. B. No. 15 ...	Ditto	Ditto	635	2	0	0	2	19	0	15	10	0	18	35	0	
		Local ...	Ditto	Ditto	635	2	15	0	2	19	0	18	4	0	18	35	0	
		E. B. No. 7 ...	Ditto	Ditto	635	1	35	0	3	11	0	14	12	0	24	38	0	
		Local ...	Ditto	Ditto	635	2	10	0	2	35	0	17	6	0	21	37	0	
		E. B. No. 17 ...	Ditto	Ditto	635	2	20	0	3	0	0	19	2	0	22	37	0	
		Local ...	Ditto	Ditto	635	1	32	0	2	10	0	13	29	0	17	6	0	

Statement No. 3

SHOWING THE RESULTS OF WATER SAVING EXPERIMENT WITH WHEAT, DURING RABI 1919-20 (COMPARISON BETWEEN NUMBERS ONE, TWO AND THREE WATERINGS AFTER SOWING).

No. of field.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Number of watering after sowing with dates.	Actual area in square yards.	Actual Outturn in Maunds.						Outturn per acre in Maunds.						Remarks.
							Grain.			*Straw.*			*Grain.*			*Straw.*			
							Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
G	Wheat ...	Pusa 12 ...	17th December 1920.	30th April 1920	*Nil* ...	3,060	7	9	0	11	34	0	11	17	0	18	30	0	The stubbles broken with Raja plough on 16th May 1919. S. T. harrow on 15th June 1919, 1st August 1919, 27th August 1919. Desi plough on 3rd September 1919. Horse hoe on 29th September 1919. S. T. harrow on 5th October 1919. Irrigated for sowing on 4th December 1919. S. T. harrow once and Sohaga twice. Desi plough once and Sohaga twice on 16th December 1919. Lever harrow on 4th January 1920. Chain harrow on 6th January 1920. Peg toothed harrow twice on 15th January 1920. Bar harrow on 8th February 1920 (with the exception of the bit to be applied three waterings after sowing) Bar harrow twice on 15th February 1920.
			Ditto	3rd May 1920	One— 7th March 1920	2,948⅔	7	12	0	11	7	0	11	39	0	18	14	0	
			Ditto	Ditto	Two— 22nd February 1920. 20th March 1920	2,512⅔	6	35	0	11	6	0	13	10	0	21	19	0	
			Ditto	Ditto	Three— 7th February 1920. 7th March 1920. 20th March 1920	2,621⅔	9	0	0	15	7	0	16	25	0	28	1	0	

Statement No. 4

WATER SAVING EXPERIMENTS WITH WHEAT DURING RABI 1919-20 (COMPARISON BETWEEN NUMBER ONE, TWO AND THREE WATERINGS AFTER SOWING).

No. of field.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Number of watering after sowing with dates.	Actual area in square yards.	Actual outturn in Maunds.						Outturn per acre in Maunds.						Remarks.
							Grain.			*Straw.*			*Grain.*			*Straw.*			
							Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
F	Wheat ...	Pusa 12 ...	19th December 1919.	30th April 1920	*Nil* ...	3,060	11	11	0	17	2	0	17	33	0	26	39	0	The stubbles broken with the Raja plough on 3rd May 1919. S. T. harrow on 15th June 1919, 1st August 1919, 27th August 1919. Desi plough on 2nd September 1919. Horse hoe on 29th September 1919. S. T. harrow on 5th October 1919. Plot was irrigated for sowing on 4th December 1919. S. P. T. harrow once, Sohaga twice. Desi plough once and Sohaga twice on 16th December 1919. Lever harrow on 4th January 1920. Chain harrow on 6th January 1920. Peg toothed harrow twice on 15th January 1920. Bar harrow 8th February 1920 and twice on 15th February 1920.
			Ditto	3rd May 1920	One— 7th March 1920	1,405⅓	4	6	0	6	24	0	14	12	0	22	29	0	
			Ditto	Ditto	Two— 22nd February 1920. 7th March 1920.	2,970⅔	9	20	0	15	30	0	15	19	0	25	27	0	
			Ditto	2nd May 1920	Three— 7th February 1920. 7th March 1920. 20th March 1920.	3,060	14	10	0	24	15	0	22	22	0	38	22	0	

Statement No. 5.

SHOWING THE RESULT OF WATER SAVING EXPERIMENT WITH TORIA DURING RABI 1919-20 (COMPARISON BETWEEN NO. ONE WATERING AFTER SOWING).

No. of field.	Previous crop.	Date of sowing.	Date of harvesting.	Number of waterings after sowing.	Actual area in square yards.	Actual outturn in Maunds.			Outturn per Acre.			Remarks.
						Maunds.	Seers.	Chatakr.	Maunds.	Seers.	Chataks.	
H. I. J.	Wheat types ...	17th September 1919 ...	16th January 1920 ...	*Nil*	7586⅔	13	39	0	8	37	0	S. T. harrow on 22nd June 1919. Raja plough on 26th June 1919. S. T. harrow on 29th June 1919 and 31st July 1919. Desi plough on 13th August 1919. S. T. harrow on 26th and 30th August 1919. Horse hoe on 8th September 1919.
		Ditto ...	Ditto ...	One	9031⅓	21	23	0	11	22	0	S. T. harrow once then seed scattered, then again S. T. harrow, once then chain harrow on 16th, 17th September 1919.

Statement No. 6.

WATER SAVING EXPERIMENT WITH TORIA CROP DURING RABI 1919-20 (COMPARISON BETWEEN 2, 3 WATERINGS AFTER SOWING).

No. of field	Previous crop.	Date of sowing.	Date of harvesting.	Number of watering after sowing.	Actual area in square yards.	Actual outturn in Maunds.			Outturn per Acre in Maunds.			Remarks.
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
H. I. J,	Wheat types ...	17th September 1919 ...	16th January 1920 ...	2 waterings ...	8846	13	25	0	7	18	0	Plowed with Raja plough on 15th May 1919. S. T. harrow on 15th June 1919, 31st July 1919. Desi plough on 8th August 1919. S. T. harrow on 26th and 30th August 1919. Horse hoe on 2nd September 1919.
		Ditto ...	Ditto ...	3 waterings ...	4578⅔	10	0	0	10	22	0	S. T. harrow once, then seed scattered and again S. T. harrow once. Then chain harrow on 16th and 17th September 1919.

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Statement No. 7.

SHOWING RESULTS OF SPACING EXPERIMENT WITH 4-F. AMERICAN COTTON TESTED IN KHARIF 1919 AT SARGODHA SEED FARM.

No. of field.	Previous crop.	Name of variety.	Distance at which sown.	Area sown in square yards.	Area destroyed by root rot in square yards.	Area harvested in square yerds.	Actual outturn			Outturn per acre on area sown.			Outturn per acre on area harvested.			Date of sowing.	Date of pickings.	Remarks.
							Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
L	Toria and Turnip	4 F	5 feet	3709⅞	482⅛	3227⅔	1	33	12	2	16	3	2	30	9	8th April 1919...	8th November 1919 and 25th November 1919, 17th December 1919 and 18th January 1920.	Raja plough on 13th January 1919. S. T. harrow on 20th January 1919. Desi plough on 4th March 1919. Desi plough on 5th March 1919. S. T. harrow on 6th March 1919. Desi plough on 12th March 1919. S. T. harrow once and sohaga twice on 2nd April 1919.
			4 feet	3600⅔	777⅐	2822⅔	1	13	12	1	32	4	2	12	3	Ditto ...	Ditto ...	Desi plough once and sohaga twice on 3rd April 1919. Desi plough once and sohaga twice on 4th April 1919. Watered on 7th June 1919, 3rd July 1919, 22nd July 1919, 6th August 1919, and 26th September 1919. Bar harrow once on 9th May 1919.
			3 feet	3600⅔	441⅕	3159⅖	1	23	2	2	4	14	2	16	12	Ditto ...	Ditto ...	Horse hoe on 9th June 1919, 26th June 1919, 5th July 1919, 26th July 1919, and 9th August 1919.

Statement No. 8.

SHOWING THE RESULTS OF SPACING EXPERIMENT WITH 4 F. AMERICAN COTTON TESTED IN KHARIF 1919 AT THE SARGODHA SEED FARM.

No. of field.	Previous crop.	Name of variety.	Distance at which sown.	Area sown in square yards.	Area destroyed by root rot.	Area harvested in square yards.	Actual outturn in maunds.			Outturn per acre on area sown.			Outturn per acre on area harvested.			Date of sowing.	Date of picking.	Remarks.
							Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
O	Chari ...	4 F	3 feet	3014	220¾	2793¼	1	14	9	2	7	9	2	14	0	8th April 1919...	8th, 26th November 1919, 17th December 1919, 18th January 1920.	Raja plough on 14th January 1919. S. T. harrow once on 14th January 1919. Desi plough once on 5th February 1919. S. T. harrow on 29th February 1919. S. T. harrow and sohaga twice on 2nd April 1919.
			4 feet	3014	307⅔	2706⅞	1	3	10	1	30	0	1	38	0	Ditto	Ditto	Desi plough twice and sohaga twice on on 3rd April 1919. Watered on 20th June 1919, 22nd July 1919, 6th August 1919, 13th September 1919 and 26th September 1919.
			5 feet	3105⅓	187⅞	1917⅝	1	24	6	2	20	5	4	2	7	Ditto	Ditto	Bar harrow on 9th May 1919 and 10th June 1919. Horse hoe 22nd June 1919, 6th July 1919, 26th July 1919 and 9th August 1919.

Statement No. 9.

STATEMENT SHOWING THE OUTTURN OF DESI AND AMERICAN COTTON VARIETIES TESTED IN KHARIF 1919 AT THE SARGODHA SEED FARM.

No. of field.	Previous crop.	Name of variety.	Area sown in square yards.	Area destroyed by root rot in square yards.	Area harvested in square yards.	Actual outturn in maunds.			Outturn per acre on the area sown.			Outturn per acre on the area harvested.			Date of sowing.	Date of picking.	Remarks.
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
M.	Toria ...	Khanna ...	1,533	376¼	1,156¾	5	4	4	16	4	14	21	14	10	26th March 1919	8th, 20th and 28th October 1919, 6th, 14th and 23rd November 1919, 5th and 22nd December 1919, and 18th January 1920.	Raja plough on 12th January 1919. S. T. Harrow twice on 12th January 1919. Desi plough on 28th February 1919, 13th March 1919, S. T. Harrow once and sohaga twice on 20th March 1919, Desi plough once and sohaga twice on 21st March 1919. Desi plough once and sohaga twice on 24th March 1919 Watered on 7th June 1919, 3rd July 1919, 6th August 1919, 26th September 1919. Bar harrow on 9th May 1919. Horse hoe on 26th June 1919, 5th July 1919 and 10th August 1919.
		285-F. ...	1,533	502¼	1,080¾	0	32	0	2	21	0	3	23	4	Ditto	7th, 18th and 27th November 1919, 17th December 1919, 18th January 1920.	
		22 Molisoui	1,533	511	1,022	4	39	5	15	29	4	23	24	0	Ditto	8th, 20th and 28th October 1919, 6th, 14th, and 23rd November 1919, 5th and 22nd December 1919, 18th January 1920.	
		280-F. ...	1,533	612½	920½	1	5	3	3	22	11	5	37	10	Ditto	7th, 18th and 27th November 1919, 17th December 1919, and 18th January 1920.	
		40 Rosea ...	1,533	794½	738½	3	24	2	11	15	0	23	24	0	Ditto	8th, 20th and 28th October 1919, 6th —14th and 23rd November 1919, 5th—22nd December 1919, 18th January 1920	
		4-F. ...	1,533	325½	1,207½	0	25	11	2	1	2	2	22	15	Ditto	7th, 18th and 27th November 1919, 17th December 1919, and 18th January 1920.	

Statement No. 10.

SHOWING THE OUTTURN OF DESI AND AMERICAN COTTONS VARIETIES TESTED IN KHARIF 1919 AT THE SARGODHA SEED FARM.

No. of field.	Previous crop.	Name of variety.	Area sown in square yards.	Area destroyed by root rot.	Area harvested in square yards.	Actual outturn in maunds.			Outturn per acre on the area sown.			Outturn per acre on the area harvested			Date of sowing.	Date of picking.	Remarks.
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
N	Toria ...	Khanna ...	1,533	385	1,148	5	0	8	15	33	0	21	5	5	26th March 1919	8th, 20th and 28th October 1919, 6th, 14th and 23rd November 1919, 5th and 22nd December 1919, 18th January 1920.	Raja plough and S. T. harrow twice on 12th January 1919.
		285-F. ...	1,533	689½	843½	0	37	0	2	37	0	5	12	10	Ditto	7th, 18th and 27th November 1919, 17th December 1919, 18th January 1920.	Desi plough on 28th February 1919, and 13th March 1919.
		22-Molisoni	1,533	399	1,134	4	32	1	15	6	6	20	19	12	Ditto	8th, 20th and 28th October 1919, 6th, 14th, 23rd November 1919, 5th and 22nd December 1919, 18th January 1920.	S. T. harrow once and sohaga twice on 21st March 1919.
		280-F. ...	1,533	497	1,036	0	35	15	2	33	7	4	7	14	Ditto	7th, 18th and 27th November 1919, 17th December 1919 and 18th January 1920.	Desi plough once and sohaga twice on 24th March 1919. Watered on 7th June 1919, 3rd July 1919, 6th August 1919, and 26th September 1919.
		40-Rosea ...	1,533	585	948	4	16	6	14	36	14	22	20	8	Ditto	8th, 20th and 28th October 1919, 6th, 14th and 23rd November 1919, 5th and 22nd December 1919, and 18th January 1920.	Bar harrow on 9th May 1919. Horse hoe on 9th June 1919, 26th June 1919, 5th July 1919, and 10th August 1919.
		4-F. ...	1,533	199⅘	1,333⅕	0	22	1	1	29	11	2	0	1	Ditto	7th, 18th and 27th November 1919, 17th December 1919 and 18th January 1920.	

Statement No. 11.

COMPARATIVE TEST OF N H_{52} × P_4 + N H_{98} × P_4 WHEATS TRIED AT SARGODHA SEED FARM DURING 1919-20.

No. of field.	Previous crop.	Name of type sown.	Average length of ear.	Average No. of grain in ear.	Weight of 100 grains in ratio.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn in maunds.						Outturn per acre in maunds.						Remarks.
									Grain.			Straw.			Grain.			Straw.			
									Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Maunds.	Chataks.	
49	Moth...	N H_{98} × P_4...	4·2875"	38	$25\frac{25}{31}$	16th December 1919	28th April 1920 ...	$2,322\frac{3}{36}$	10	36	8	23	17	8	22	29	9	48	32	8	200 maunds of farm yard manure.
15		N H_{52} × P_4...	3·9"	35	$26\frac{7}{8}$	Ditto	Ditto ...	$2,317\frac{7}{8}$	8	30	8	15	26	8	18	12	6	32	28	8	150 maunds of farm yard manure. The seed received was very late and field had already been manured.

Statement No. 12.

SHOWING THE COMPARATIVE TEST OF LOCAL AND FRENCH OATS TESTED AT THE SARGODHA SEED FARM DURING RABI 1919-20.

No. of plot.	Previous crop.	Name of variety.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn.						Outturn per acre.						Remarks.
						Grain.			Straw.			Grain.			Straw.			
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
D	Wheat ...	French oats ...	1st November 1919...	18th May 1920 ...	$466\frac{2}{3}$	0	22	0	7	20	0	5	28	6	77	31	6	The stuble broken with Raja plough on 3rd May 1920 S. T. harrow on 16th June 1919, 4th August 1919, and 29th August 1919. Desi plough on 31st August 1919. Horse hoe on 24th September 1919. S. T. harrow on 25th September 1919. Field was watered for sowing on 28th October 1919. Then S. T. harrow, once, sohaga twice. Desi plough once, sohaga twice. Sown on 1st November 1919. Then chain harrow after sowing Again chain harrow on 1st December 1919. Peg toothed harrow on 17th January 1920.
		Local oats ...	Ditto ...	10th April 1920 ...	$466\frac{2}{3}$	2	20	0	5	0	0	25	37	$2\frac{2}{7}$	51	34	$4\frac{4}{7}$	
		French oats ...	Ditto ...	18th May 1920 ...	$466\frac{2}{3}$	0	17	0	6	0	0	4	16	5	62	9	$2\frac{2}{7}$	
		Local oats ...	Ditto ...	10th April 1920 ...	$466\frac{2}{3}$	1	32	0	5	0	0	18	26	12	51	34	$4\frac{4}{7}$	
		French oats ...	7th November 1919	19th May 1920 ...	$888\frac{8}{9}$	1	29	0	14	0	0	9	15	$10\frac{4}{5}$	76	9	$3\frac{1}{5}$	
		Local oats ...	Ditto ...	10th April 1920 ...	$888\frac{8}{9}$	3	30	0	9	20	0	2	16	12	51	29	$1\frac{3}{5}$	

Statement No. 13.

SHOWING THE COMPARATIVE TESTS OF DIFFERENT WHEAT TYPES TRIED AT THE SARGODHA SEED FARM DURING RABI 1919-20 (LATE SOWN AREA).

No. of field.	Previous crop.	Name of types sown.	Average length of the ear in inches.	Weight of 10ℓ grains in ratis.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Average number of grain in ear.	No. of tillers.	Actual outturn in maunds. Grain. Maunds.	Seers.	Chataks.	Straw. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Straw. Maunds.	Seers.	Chataks.	Remarks.
D.	Wheat	8-A ...	3·6625	32	7th November 1919	28th April 1920 ...	1,299 5/9	41	18	5	27	0	12	1	0	21	5	0	46	31	0	
		C-13 ...	4·75	33⅓	Ditto	15th April 1920 ...		51	9	5	16	0	14	33	0	20	4	7	55	8	9	
		8-A ...	3·6625	32	Ditto	28th April 1920 ...		41	18	5	29	0	14	2	0	21	13	0	52	13	0	
		No. 11 ...	4·2625	22 9/19	Ditto	25th April 1920 ...		51	9	5	33	8	17	35	1	21	28	0	66	23	2	Raja plough on 3rd May 1919. S. T. harrow on 16th June 1919, 1st August 1919, and 29th August 1919. Desi plough on 1st September 1919. Horse hoe on 23rd September 1919. S. T. harrow on 5th October 1919 and 25th September 1919. Fields watered on 28th October 1919 for sowing, then S. T. harrow once, sohaga twice. Desi plough once and sohaga twice on 6th November 1919. Then harrow once just after sowing, again chain harrow on 1st December 1919. Peg toothed harrow on 1st January 1920, 9th January 1920, and on 15th January 1920.
		8-A ...	3·6625	32	Ditto	28th April 1920 ...		41	18	6	2	0	11	25	0	22	21	0	43	12	0	
		9-C ...	4·0875	25 21/31	Ditto	20th April 1920 ...		45	10	4	31	0	11	23	0	17	30	11	43	4	6	
		8-A ...	3·6625	32	Ditto	28th April 1920 ...		41	18	5	30	0	10	25	0	21	17	0	39	23	0	
		17-B ...	4·0125	30 12/18	Ditto	17th April 1920 ...		28	9	4	28	0	10	22	0	17	20	3	39	11	10	
		8-A ...	3·6625	32	Ditto	28th April 1920 ...		41	18	6	4	0	10	4	0	22	29	0	37	25	0	
		Punjab 14	4·1125	26⅔	Ditto	19th April 1920 ...		49	10	5	27	0	12	16	0	21	5	7	46	7	4	
		8-A ...	3·6625	32	Ditto	28th April 1920 ...		41	18	6	4	0	13	23	0	22	29	0	50	22	0	
		Pusa 12...	5·0375	34 3/17	Ditto	16th April 1920 ..		46	8	7	39	0	15	19	0	29	28	0	57	25	0	
		8-A ...	3·6625	32	Ditto	28th April 1920 ...		41	18	8	10	0	18	13	0	30	29	0	68	10	0	
		8-B ...	3·775	27 11/19	Ditto	25th April 1920 ...		48	10	6	20	8	22	8	0	24	10	3	82	27	0	
		8-A ...	3·625	32	Ditto	28th April 1920 ...		41	18	7	18	0	19	19	0	27	29	14	72	21	4	

Statement No. 14.

SHOWING THE COMPARATIVE TEST OF DIFFERENT WHEAT TYPES TRIED AT THE SARGODHA SEED FARM DURING RABI 1919-20 (EARLY SOWN AREA).

No. of field.	Previous crop.	Name of type sown.	Average length of the ear in inches.	Weight of 100 grains in ratio.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Average number of grains in one ear.	No. of tillers.	Actual outturn in maunds.						Outturn per acre.						Remarks.
										Grain.			*Straw.*			*Grain.*			*Straw.*			
										Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
A, B C.	Cotton varieties.	8-A ...	3·6625	32	26th 27th October 1920.	27th April 1920 ..	2,705⅝	41	18	16	11	0	32	21	0	29	4	0	58	4	0	
		C-13 ...	4·75	33⅓	Ditto	15th April 1920 ...		51	9	10	12	0	28	27	0	18	16	15	51	11	11	
		8-A ...	3·6625	32	Ditto	27th April 1920 ...		41	18	11	16	0	21	30	0	20	16	0	38	37	0	Raja plough on 20th February 1919. S. T. harrow on 22nd March 1919, 19th June 1919 and 21st August 1919.
		No. 11 ...	4·2625	22⅝	Ditto	24th April 1920 ...		57	9	11	19	4	28	36	8	20	21	8	51	23	11	
		8-A ...	3·6625	32	Ditto	27th April 1920 ...		41	18	13	37	0	25	8	0	24	36	5	45	31	0	Desi plough on 16th August 1919. S. T. harrow on 30th August 1919. Desi plough on 19th September 1919.
		9-C ...	4·0875	25$\frac{25}{31}$	Ditto	20th April 1920 ...		45	10	12	34	0	34	0	0	22	39	6	60	32	11	
		8-A ...	3·6625	32	Ditto	27th April 1920 ...		41	18	16	13	0	41	5	0	29	8	0	37	22	0	Horse hoe on 29th September 1919.
		17-B ...	4·0125	30$\frac{19}{23}$	Ditto	17th April 1920 ...		28	9	14	27	0	38	20	0	26	9	5	68	34	10	S. T. harrow on 4th October 1919. Watered for sowing on 15th October 1919.
		8-A ...	3·6625	32	Ditto	27th April 1920 ...		41	18	16	5	0	32	10	0	28	34	0	57	27	0	Sohaga once, S. T. harrow once, then sohaga thrice on 20th October 1919.
		Punjab 14	4·1125	26⅔	Ditto	19th April 1920 ...		49	10	14	15	8	37	32	0	25	29	6	67	24	9	Desi plough once, sohaga thrice on 22nd October 1919.
		8-A ...	3·6625	32	Ditto	27th April 1920 ...		41	18	15	1	0	30	14	0	26	35	0	54	12	0	Chain harrow on 15th November 1919.
		Pusa 12...	5·0375	34$\frac{3}{47}$	Ditto	16th April 1920 ...		46	8	13	34	0	27	24	0	24	31	0	49	15	0	Peg toothed harrow on 30th November 1919, and twice on 8th February 1920.
		8-A ...	3·6625	32	Ditto	27th April 1920 ...		41	18	13	36	0	26	1	0	24	34	7	46	22	1	
		8-B ...	3·775	27$\frac{7}{39}$	Ditto	21st April 1920 ...		48	10	14	3	12	30	31	0	25	8	0	55	2	0	
		8-A ...	3·6625	32	Ditto	27th April 1920 ...		41	18	14	1	0	28	15	0	25	3	8	50	30	3	

Annual Report of the experiments at the Hansi Agricultural Station by Sardar Darshan Singh of Vahali, I.A.S., Deputy Director of Agriculture, Punjab, Hansi, for the year ending 30th June 1920.

Introductory.—The Hansi Farm is now in its 6th year and I have been in charge since its start. One of the main objects or rather the main object of this Farm was to find out a suitable variety of desi cotton for this part of the Province (see page 4, paragraph 10 of Mr. Hamilton's Annual Report of 1913). I feel I am now in a position to say that thie object has been achieved, and I have now got a selection of desi cotton which has for the past 4 years invariably given the highest profits per acre among the desi cottons, and indeed competes very favourably in profits with the best of Americans. (The cotton crop of the year 1917 totally failed on account of the heavy rains and therefore has not been taken into consideration.) The work of isolating the 4 different types among the desi cottons of the village Bhatla (the best known village in the tract for cottons) was commenced from the time I took over charge of this Farm, and further selections have continually been made (see my annual reports of 1915, 1916, 1917, 1918 and 1919).

The average yield of this selection for the year under report is Mds. 11-11-2 per acre as compared with Mds. 4-38-15 the average yield of the irrigated cotton in this district. The maximum yield has, however, been over 17 maunds per acre. The average yield of last year was Mds. 13-8-13 and the maximum was 16½ maunds.

The lint percentage has been 40 per cent. which is about 3 seers above lint yield of the ordinary desi cotton per maund. Messrs. Tata & Sons have given the highest valuation for the lint of this variety among all the desi cottons grown at this Farm and sent to them for valuation. I may here add that the varieties of desi cottons considered best at Lyallpur have been grown here since the start of the Farm and given a comparative test. The results now show that this selected cotton is the heaviest yielder with a high percentage of lint and a good valuation (see statement No. 2). The cultivators of this tract appreciate this selection, and the demand for its seed at the sowing time was very great which indicates that it had already gained popularity. We should now concentrate our efforts to producing enough pure seed of this variety for distribution in this tract. With this point in view I have already approached the Government for sanctioning a ginning installation at the Hansi Farm. It will also be necessary to start with, that we have a large area for multiplying this seed under the direct departmental supervision.

The average yield of irrigated wheat at the Farm was Mds. 25-32-7 per acre as compared with Mds. 12-7-12, the average yield of the irrigated wheat of this district, while in certain fields the yield has been over 32 maunds.

The area under our direct control is a little over 100 acres. The gross income for the year ending 31st March 1920 was Rs. 8,916. For the balance of the area we have now been able to secure 5 tenants and a regular cropping scheme has been drawn up for them by me Huts are badly required to accommodate these tenants.

Season and its effects.—The total rainfall at the Hansi Agricultural Station during the year under report has been 10·28 inches (*vide* statement No. 1) as compared with 15·24 inches the average rainfall of the district. The year was very unfavourable for barani crops, as we did not have much rain till about the latter half of the month of July. The sowings of kharif crops and specially the cotton got greatly delayed. In the month of August we had about 2 inches of rain, but the subsequent months were practically rainless; therefore the kharif crops dried up for want of moisture and barani rabi could not be sown at all, except an acre of early grams. On account of the dryness of the season and low humidity there was shedding of flowers and buds among cottons and this was specially marked in the case of Americans. The canal-irrigated crops also suffered for want of water as the supply in canal remained irregular and insufficient, and we could have no waterings to our wheats during the month of February. There were some light showers of rain from December to March which helped the wheats. The sugarcane suffered from frost and the quality of our gur was affected specially during the latter part of the crushing season. The early wheat crop also suffered from frost.

Cottons.—Forty acres of irrigated cotton and 2 acres of barani cotton were grown at the Farm under various experiments. Five different American varieties, *i.e.*, 280-F., 275-F., 161-A. F., 4-F. and Narma of Pasina Kalan and 8 desi varieties, *i.e.*, No. 74 Neglectum white flowered Bhatla selected, Neglectum yellow flowered Bhatla selected, Indicum white flowered Bh. S., Local Bhatla, Mollisonea 24, Rosea 132 and Rosea 87, were tried against Neglectum white flowered Bhatla selected which was used as standard. Among the desi varieties, Neglectum white flowered Bhatla selected No. 74 has given the highest yield of Mds. 11·11-2, while among the Americans there is very little difference in yield except in the case of 4-F. American which seems to have particularly suffered during the present season (for full particulars see statements Nos. 3 and 4).

Series No. 1 – Varietal test.

Series No. 2—Spacing experiment.

These were tried with (1) 4-F. American and (2) with white flowered Neglectum Bh. S. and the spacings were the same as in previous year, *i.e.*, 4, 3½, 3 and 2½ feet for the Americans and 2½, 2, 1½ feet for the desis. The experiments were tried in duplicate. The average yield per acre is as follows:—

4-F. American.		*1st set.*			*2nd set.*		
		Mds.	Srs.	Chks.	Mds.	Srs.	Chks.
4 feet ...	...	9	1	0	11	3	5*
3½ ,, ...	...	10	11	0	9	24	14
3 ,, ...	...	9	28	2	8	13	14
2½ ,, ...	...	8	29	7	6	3	0

*Soil of this plot is better and therefore should not be taken into consideration (see statement No. 5).

The results confirm our previous year's experience that 3 to 3½ feet is the best distance for spacing the Americans. It is regretted that owing to the uneven nature of the soil the conclusions of experiments in hand have to be continually modified depending a great deal on personal observations.

NEGLECTUM WHITE FLOWERED BHATLA SELECTED.

Spacing.	*Outturn per acre.*		
	Mds.	Srs.	Chks.
2½ feet	6	6	11½
2 ,, ...	7	6	1
1½ ,, ...	8	0	8

(For full particulars see statement No. 6.)

SERIES No. 3.

(a)—Different number of hoeings in broad cast cotton.

Greater number of hoeings has resulted in the increase of yield—

	Mds.	Srs.	Chks.
2 hoeings with kasola	10	13	0
3 ,, ,, ,, ...	10	25	0
4 ,, ,, ,, ...	10	34	1

(For detail see statement No. 7.)

(b)—Broadcasting versus *sowing in lines.*

Four hoeings with kasola were given to both the plots. The broadcasted has given the greater yield. This also confirms our previous year's experiments with desi cottons.

	Kharif 1919.			*Kharif* 1918.			*Kharif* 1917.	*Kharif* 1916.	*Kharif* 1915.		
	Mds.	Srs.	Chks.	Mds.	Srs	Chks.			Mds.	Srs.	Chks.
Broadcast ...	10	34	1	11	9	8	Crop destroyed on account of heavy rain.	Crop destroyed	11	32	14
In lines ...	9	39	6	8	7	1	Ditto	Ditto	9	3	6

(For full detail see statement No. 8.)

(c)—Same number of hoeings to cotton in lines, but with different kinds of hoes.

Three hoeings were given to line-sown cotton with kasola, country plough, Horse hoe and Gujrat Hoe.

(For results see statement No. 9.)

SERIES No. 4.

Deep and shallow ploughing as preparation for cotton sowing.—Three fields were prepared with country, Rajah and Sabul ploughs respectively. The deeper ploughing has increased the yield of cotton. The highest yield was obtained from the plot prepared with Sabul plough. These results confirm our last year's experiment.

	Present kharif.			*Last kharif.*		
	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.
Country plough	... 8	33	1	8	0	1
Rajah plough (4½″ deep)	... 8	10	6	9	24	0
Sabul plough (9″ deep)	... 11	22	6	12	15	11

(See statement No. 10.)

Experiment with early and late sown American and desi cotton.—4-F. American and white flowered Neglectum Bh. S. were tried side by side to see which variety would yield

better if sown late. In case of late sowings different seed rates were tried to see if heavier seed rate can to any extent counterbalance the effect of lateness. The results in all cases are in favour of, Neglectum white flowered Bh. S.—

Variety.	*Early sown.*			*Late sown* (6 *seers seed rate*).			*Late sown* (10 *seers seed rate*).		
	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.
4-F	15	9	6	12	15	0	11	11	4
Neglectum white fld. Bh. S.	17	0	12	13	14	8	11	29	12

(For full detail see statament No. 11.)

Experiment to see water requirements of cottons —The object of this experiment was to see the most suitable number of waterings for cotton and to find out how far the hoeing of cotton can save the number of waterings. This was tried with one American and 2 desi cotton varieties, namely, 4-F. American and white fld. Neglectum Bh. S. and white fld. Indicum Bh. selected. As a rule a cultivator does not take the trouble of hoeing his cotton properly and makes this up to his thinking in greater number of watering.

In this experiment we are trying 5 waterings and 1 hoeing, 4 waterings and 2 hoeings and so on up to 1 watering and 5 hoeings. It will be seen from this as well as from the last year's results that the best results are obtained with about 3 waterings and 3 to 4 hoeings. This year as we had about 4·17 inches of rain in July, only 2 waterings were enough and 2 waterings with 4 hoeings have given the best results in all the three cases. (See statement No. 12).

Manurial experiments with cottons.—1. Use of cotton sticks :—

The object of this experiment is to make manurial use of cotton sticks instead of allowing them to stand in land after the crop is over—

(*a*) Application of ashes of burnt cotton sticks.

(*b*) Removing and rotting cotton sticks and applying organic matter.

(*c*) Removing cotton sticks after last picking.

(*d*) Leaving cotton sticks for a long time and removing them before sowing the following crop, which is the common practice of the cultivator.

This experiment was made in Block D, half of field 15 and fields 16 and 17. The soil of the fields 15 and 16 is uneven and reliable results are not available. However in plot No 17 where part of the field was given ashes and part had none the results are in both cases in favour of applying ashes.

Variety.	*Ashes.*			*No ashes.*		
	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.
4-F.	4	17	12	3	38	4
Neglectum white fld. Bh. S. ...	5	33	12	4	11	4

(For full detail see statement No. 13.)

2. Ten lbs. of nitrogen per acre in the form of sodium nitrate and potassium nitrate are being applied in conjunction with farm yard manure. The results are unreliable owing to land being uneven in nature.

Permanent cotton plot.—An experiment was made to see how far growing cotton after cotton on the same land every year without returning anything to the soil affects its fertility. The experiment was started in 1915 and the results are interesting, as they show a gradual decrease in yield every year, and this year which is the 5th year since the experiment was started, the actual yield is less than have of the first year of the experiment.

1915.			1916.			1917.			1918.			1919.		
Mds.	Srs.	Chks.	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.
11	22	10	10	9	0	0	30	1*	7	26	9	5	8	5

(*Crop destroyed by excessive rain.)

(For full detail see statement No. 14.)

Experiment with barani cotton.—Two acres were sown with barani cotton during the kharif 1919. One of them was divided into two parts, and in half of this field, half an inch layer of sand was applied before sowing as the land of Hansi Farm is very heavy sticky and not fit for barani cultivation. The experiment is very interesting indeed, as the sand

helped a great deal in opening up of the soil, and the results obtained are remarkable. The plot where sand was applied gave almost twice the yield.

	Mds.	Srs.	Chks.
Plot where sand was applied	7	2	14
Plot where no sand was applied	3	25	12

(See statement No. 15.)

Thinning experiment.—This was started to find out the best stage at which cotton should be thinned. It was intended to thin cotton when 1, 2 and 3 feet high. Very little thinning was actually done as the crop was already not very heavy. (See statement No. 16.)

Miscellaneous experiment with cotton.—Environment experiments with cotton were carried out for the Economic Botanist with his varieties 133-*b*, 199-*f* and Multani (see statement No. 17).

A parasite breeding plot was kept for Professor of Entomology.

History of plant to plant selection of desi cottons.—As mentioned in the earlier part of the report the work of isolating pure types from Bhatla mixture was taken in hand from the very start of the Farm, *i.e.*, year 1914, when I took over charge. Four types were isolated in 1914 and grown in the year 1915. Neglectum white flowered Bhatla selected gave the highest yield of Mds. 9-4-15 and Indicum white flowered Bhatla selected gave the highest lint percentage of 36·38 per cent., but Neglectum white flowered Bhatla selected was still the best in terms of lint as its yield was Mds. 3-7-1¾ against a yield of Mds. 3-2-12¼ of Indicum.

White flowered Bhatla selected.—These varieties were included in the scheme of our varietal test with cotton and have ever since been grown there.

Besides 58 plants of desi cotton, bearing good fruit and having a lint percentage of 35 per cent. or over were then selected from these two varieties and seed obtained from these was grown in separate lines during the year 1916 for further selection.

From these 58 rows grown from the selected seed 150 plants were selected in the field during the year 1917, and out of these seeds only 38 plants giving a ginning percentage of over 41 per cent. were kept for next year's sowing. The remaining were rejected. In the year 1918 further selections were made on the same lines and our Neglectum white flowered Bhalta selected No. 74 which seemed very promising was multiplied for field trials. During the year 1919 this particular selection was also included among the varietal test experiment, and it has given the highest yield topping Neglectum white flowered Bhalta selected which for the past three years has given the highest yield among the desi cottons and from this the present selection has been made.

Wheats.—Eighteen acres of irrigated wheat were sown this year under various experiments. No barani wheat could be sown on account of the lack of rains at the sowing time.

Varietal test of wheat.—The same 8 varieties of wheat as grown last year, *i.e.*, 8-A, 8-B, 9-C, 17-B, 20-C, Punjab 17, Punjab 11 and Pusa 12 were again tested against Punjab 14 as standard. The varieties were sown in duplicate. Like last year 8-A has this year also given the highest yield followed by Punjab 11.

The average yields per acre are as follows :—

Name of variety.	Average yield per acre.			Average yield per acre in terms of standard.			Increase or decrease as compared with standard.		
	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.
8-A	30	12	8	27	31	4	+ 2	21	4
Punjab 11	28	22	8	26	16	4	+ 2	6	4
9-C	29	10	0	28	1	4	+ 1	8	12
17-B	24	33	12	24	0	12	+ 0	33	0
Punjab 14	26	33	14	26	33	14	*Nil.*		
Punjab 17	25	10	0	25	31	13	— 0	6	13
20-C	26	30	0	28	36	14	— 2	6	14
Pusa 12	26	25	0	28	36	0	— 3	11	3
8-B	24	32	8	29	10	0	— 4	17	8

(For full detail see statement No. 18.)

The results of trials made on the tenants' area also confirm the above results. (See statements Nos. 18-A, 18-B, 18-C, 18-D.)

Deep and shallow cultivation for wheat.—Sabul, Rajah and country plough were used in one acre plot each. Deep ploughing has resulted in the increase of yield of both grains and bhusa as in previous years :

	Mds	Srs.	Chks.
Sabul plough	30	21	14
Rajah „	30	18	12
Country „	27	0	5

(See statement No. 19.)

Sowing of wheat by various methods.—Wheat 8-A like last year was sown with Akola drill, Lyallpur drill, Poona drill, New drill prepared by the Deputy Director, Hansi, shallow nali with sohaga, country method (sowing with pora and no sohaga) and country method followed by sohaga just after the start of germination, which was substituted in place of country method followed by sohaga directly, this having been given up this year as the seed went too deep and the germination obtained was defective. The object of this experiment is to get a good germination, and a level surface for interculture, weeding and reaping by machinery. The soil was uneven and also the fields could not be sown at one and the same time. Observations were however made at the time of germination. The germination of the plot sown with Hansi drill was by far the best, and this drill was also the most economical to use. The zamindars who paid a visit during the early stages of wheat crop also made the same observation.

Interculture experiment with wheat.—Three acres of land were kept for harrowing with Chain, Lever and Bar harrows respectively and were interstripped with plots where no harrowing was to be done. Only one harrowing was actually done before watering and afterwards the season did not permit of the complete operation. The crop also lodged and therefore results are not worth much consideration.

Permanent wheat plot.—This experiment of growing wheat after wheat in the same plot without adding anything to the soil was started in 1916 to see how far this practice affects the fertility of the soil. The results show that there has been a gradual decrease in the yield which is now about half of what it was in 1916 when this experiment was started :

	Mds.	Srs.	Chks.
Rabi 1916-17	30	20	0
„ 1917-18	22	20	0
„ 1918-19	19	10	0
„ 1919-20	15	14	0

(Statement No. 20.)

Sugarcane.—Three acres of sugarcane were grown and the following varieties were tested :—

Suretha, Lalri, Mango, Dhaura, Bihar and Local.

The varieties were sown in duplicate with the exception of Dhaura. Fiftten tons farm yard manure per acre was applied. The variety Dhaura does not seem to do well here and will be given up from next year and in its place Jawa 105 will be tried. This variety was also grown this year, but on a very small scale and all the good canes have been reserved for next year's seed. (For full detail see statement No. 21.)

Barley and gram.—The same 4 varieties of barley as tried last year were again grown this year at the Farm. Types Nos. 4 and 5 have given the best results : of these type No. 4 is also an early ripening one. As this is only the second year of the trial of these varieties I defer from giving any definite opinion. These varieties were also tried at three different places in the district of Gurgaon where type No. 4 has topped the list in each case. (See statements Nos. 22 and 22-A.)

I obtained 3 varieties of gram from Burma 2 years ago and 4 varieties were received from Economic Botanist, Punjab, this year. All these 7 varieties were tried against the local. The local grams have done the best. Economic Botanist's type No. 7 and white Burma No. 1 are also promising. (For full detail see statement No. 23.)

Mustard.—Brown and yellow varieties of Mustard which were received from Messrs. Graham & Co., Calcutta, and were tried last year were again given a trial against the local variety. Both the varieties received from Messrs. Graham & Co. have like the last year yielded very poorly as compared with the local. There is very little use in further continuing this experiment. (See statement No. 24.)

Toria (Brassica campestris).—This is a new crop for this tract and was sown in rotation with American cotton and wheat. It was sown in the month of September and harvested in January. It was slightly damaged by aphis. The average outturn was Mds. 9-37-11 which was sold at the rate of Rs. 12-5-0 per maund.

Bajra (Pennisetum Typhoideum).—Both Australian and local bajra were tried under irrigated as well as barani conditions. (For results see statements Nos. 25 and 26.)

Besides growing Japan rape, varieties of jowar, senji, gowar, which have been grown here for fodder purposes since the start of the Farm, a trial was also given this year to oats, barley, shaftal, barseem, mangold and beet root.

Little success has been achieved with drought resisting grasses and fodder plants. A special Agricultural Assistant is needed to look after this branch of work. The present staff of one Manager and one certified man under training as Assistant Manager is hardly enough to cope with the experimental work already in hand.

The thornless Cactus has made very little progress during the year and needs plenty of irrigation and a good deal of attention.

Silage.—Jowar was ensilaged in the month of September 1919 and fed during the month of April and first half of May 1920 when green fodder was much needed. It kept in very good condition and the cattle ate it with relish.

Visitors.—The Farm was visited by many officials and cultivators of the districts of Hissar, Rohtak, Karnal, Ambala and Ferozepore. Inspectors and Sub-Inspectors of Co-operative Credit Societies working in the districts of my circle were received at the Farm during the early part of the month of November 1919 in consultation with the Registrar, Co-operative, Credit Societies, and were given a short course of lectures and demonstration.

Arrangements were made with the Deputy Commissioners and parties of Revenue Officers, and selected cultivators were received from the various districts, who were all shown over the various experiments that are being conducted at the Farm and a practical demonstration of all implements was given. The zamindars seemed much impressed with what they saw at the Farm and the new drill prepared at Hansi seemed to greatly appeal to their mind. A big gathering of the officials and cultivators of the Hissar District was arranged at the time of autumn meeting of the Agricultural Association, Hissar District.

Implements.—Among the new implements tried at the Farm might be mentioned the Disc harrow. This harrow seems very suitable for heavy lands of the type we have got at this Farm.

The new drill prepared by the Deputy Director of Agriculture, Hansi, gave very good germination and was much appreciated by the Revenue Officers and the cultivators. Efforts are being made to substitute suitable discs for the sowing of jowar, gram, and cotton. The original discs were prepared for the sowing of wheat and barley.

The land of this Farm is very uneven and saline in nature, with patches of kallar soil in nearly all the fields which hamper the experimental work that is being done here. Deep cultivation with heavy watering ought to help in bringing about more uniform condition. This can be best achieved by using motor tractors.

Besides, the surrounding land has been granted to gentlemen in reward for War services. This land is now being broken up and there seems an ideal chance for the trial and introduction of motor tractors here. I have discussed this matter with several of the grantees and they seem to be willing to give it a trial. If a tractor were purchasd for this Farm, we will get an idea as to how it will work both under zamindari conditions and at the Government Farms. The direct supervision of the department under which tractor would work here on zamindari lands ought to be a great advantage.

Want for new works.—Owing to the entertainment of the tenants the area under cultivation has been nearly doubled. The present store was already insufficient for holding the Farm produce. Almost double the cotton produce is anticipated during the coming season. Some temporary arrangements will be necessary before permanent buildings can be constructed. Extension of the present stores is urgently needed.

Great inconvenience was felt at the time of the visits of the parties from the various districts, specially as the town is about 4 miles away. A sarai for the visitors and a rest-house for the officers is indispensable.

The connecting pacca road between Gosain Gate and the road leading to the canal rest-house will avoid the circutous way of going through the town and it will be a great convenience to the visitors and the Farm establishment.

DARSHAN SINGH,

Dated 30th July 1920. *Deputy Director of Agriculture, Punjab,*

Second Circle, Hansi.

Statement No. 1.

SHOWING THE RAINFALL AT HANSI AGRICULTURAL STATION DURING THE YEARS 1918 19 AND 1919-20.

Name of month.	Rainfall during 1918-19.	Rainfall during 1919-20.	Remarks.
1	2	3	4
June	0·12	0·05	
July	1·26	4·17	
August	8·31	1 92	
September	0·12	0·84	
October	*Nil*	*Nil*	
November	*Nil*	*Nil*	
December	*Nil*	0·47	
January	0·95	0·24	
February	0·20	0·64	
March	0·04	1·10	
April	0·17	*Nil*	
May	0·16	·85	
Total ...	11·83	10·28	

Statement No. 2

SHOWING THE VALUATION OF LINT OF COTTON VARIETIES PER ACRE, GROWN AT THE HANSI FARM DURING KHARIF 1919, AS VALUED BY MESSRS. TATA & SONS BOMBAY.

Serial No.	Name of variety.	Weight of cotton (Kappis) per acre.			Weight of lint per acre.			Percentage of lint to cotton.	Valuation of lint per maund.	Amount per acre.	Remarks.
		Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.				
									Rs. A. P.	Rs. A. P.	
1	White Fld. Neglectum Bh. S. ..	8	23	12	3	9	10	37·70	31 4 0	101 4 4	This is average of 26 plots, some of which were of very poor quality.
2	Rosea 74, Bh. S.	11	11	2	4	22	9	40·46	31 4 0	142 10 0	
3	White Fld. Indicum Bh. S. ...	10	20	2	3	36	9	37·27	30 0 0	117 6 9	
4	Yellow Fld. Neglectum Bh, S.	7	30	15	2	27	12	34·64	31 4 0	84 2 10	
5	„ „ Indicum Bh. S ...	8	3	14	2	32	2	34·62	30 0 0	84 1 4	
6	Rosea 132	8	34	8	3	24	12	40·83	30 0 0	108 9 0	
7	„ 87	6	32	0	2	25	3	38·67	30 0 0	78 14 9	
8	Mollisonea 24	7	38	2	5	8	9	40·42	27 8 0	88 6 3	
9	4-F.	4	20	6	1	15	8	30·76	46 4 0	64 2 9	
10	280-F.	7	22	14	2	12	10	30·59	56 4 0	130 4 0	
11	275-F.	7	34	14	2	24	15	33·33	35 0 0	91 13 1½	
12	161-A. F.	7	7	0	2	13	8	32·58	43 12 0	102 4 0	
13	Narma of Pasina Kalan ...	6	33	7	2	11	9	33·43	35 0 0	80 1 10	
14	„ „ Khojgipur ...	...	...	...	...	..	...	31·78	37 8 0	...	Its area is not given as it was tried in plant to plant selection only.
15	Local Bhatla ...	7	8	5	2	19	2	34·18	27 8 0	68 2 4	
16	Old Local Bhatla	...	...	...	...	...	...	35·35	18 12 0	...	It was not tried in varietal test.
17	Mollisonea 84	9	27	8	3	37	10	40·63	25 0 0	98 8 3	

Statement No. 3

CONSOLIDATED STATEMENT OF VARIETAL TEST OF COTTON AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Name of variety.	Average yield per acre.			Remarks.
		Maunds.	Seers.	Chataks.	
1	Rosea Bh. Selected	8	23	12	This is average of 26 plots, some of which were of very poor quality.
2	Rosea 74	11	11	2	
3	Mollisonea	10	20	2	
4	Neglectum Yellow Fld. Bh S.	7	30	15	
5	Indicum „ „ „	8	3	14	
6	Rosea 132	8	34	8	
7	Rosea 87	6	32	0	
8	Mollisonea 24	7	38	2	
9	4-F. Cotton	4	20	6	
10	280-F.	7	22	14	
11	275-F.	7	34	14	
12	161-A. F.	7	7	0	
13	Narma of Pasina Kalan	6	33	7	

Statement No. 4

SHOWING THE RESULTS OF VARIETAL EXPERIEMENT WITH COTTON CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1919.

I Set.

Serial No.	Block and plot.	Variety.	Areas sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Outturn per acre in terms of standard. Maunds.	Outturn per acre in terms of standard. Seers.	Outturn per acre in terms of standard. Chataks.	Remarks.
1	C / 1 *a*	Rosea No. 74	59/240	59/240	8th April 1919 ...	26th September 1919 ...	19th December 1919 ...	3	0	5	12	9	6	11	21	7	Ploughings ... 5 Harrowings ... 5 Suhagings ... 8 Hoe'ngs ... 6 Waterings ... 4
2	C / 1 *b*	Rosea Bhatla S.	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	2	33	7	11	21	7	11	21	7	
3	C / 2 *a*	Indicum white flowered ...	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	2	25	10	10	29	11	12	8	6	
4	C / 2 *b*	Rosea Bhatla S.	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	3	6	11	12	35	5	12	35	5	
5	C / 3 *a*	Neglectum yellow flowered Bhatla S.	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	1	25	12	6	27	7	11	2	6	
6	C / 3 *b*	Rosea Bhatla S.	Do.	Do.	Ditto	Ditto ...	Ditto ...	2	10	13	9	9	7	9	7	9	
7	C / 4 *a*	Indicum yellow flowered Bhatla S.	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	2	10	8	9	8	2	8	39	10	
8	C / 4 *b*	Rosea Bhatla S.	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	2	6	0	8	29	13	8	29	13	
9	C / 5 *a*	Local Bhatla	Do.	1,106/4,840	Ditto ...	Ditto ...	Ditto ...	1	32	10	7	37	13	8	14	10	
10	C / 5 *b*	Rosea Bhatla S.	Do.	1,160/4,840	Ditto ...	Ditto ...	Ditto ...	1	36	9	7	39	7	7	39	7	

11	C / 6 *a*	Rosea 132	Do.	59 / 240	Ditto ...	Ditto ...	Ditio ...	1	39	11	8	4	2	8	1	7½
12	C / 6 *b*	Rosea Bhatla S.	Do.	1,165 / 4,840	Ditto ...	Ditto ...	Ditto ...	1	37	14	8	3	8	8	3	8
13	C / 7 *a*	Rosea 87	Do.	59 / 240	Ditto ...	Ditto ...	Ditto ...	1	24	15	6	24	2	8	6	12
14	C / 7 *b*	Rosea Bhatla S.	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	2	1	2	8	10	0	8	10	0
15	C / 8 *a*	Mollisonea 24	Do.	Do.	Ditto	Ditto ...	Ditto ...	2	4	4	8	22	11	7	11	14
16	C / 8 *b*	Rosea Bhatla S.	Do.	Do.	Ditto ...	Ditto ...	Ditto ...	1	22	6	6	13	12	6	13	12
17	C / 9 *a*	4 F.	Do.	Do.	Ditto ...	17th October 1919 ...	Ditto ...	1	4	14	4	22	9	7	32	7
18	C / 9 *b*	Rosea Bhatla S.	Do.	Do.	Ditto ...	26th September 1919 ...	Ditto ...	2	9	9	9	11	2	9	11	2
19	C / 10 *a*	280-F.	Do.	Do.	Ditto ...	17th October 1919 ...	Ditto ...	1	12	14	5	15	1	8	7	12½
20	C / 10 *b*	Rosea Bhatla S.	Do.	Do.	Ditto ...	26th September 1919 ...	Ditto ...	1	27	15	7	4	7	7	4	7
21	C / 11 *a*	275-F.	Do.	Do.	Ditto ...	17th October 1919 ...	Ditto ...	1	34	0	7	21	0	7	24	½
22	C / 11 *b*	Rosea Bhatla S.	Do.	Do.	Ditto ...	26th September 1919 ...	Ditto ...	1	39	9	8	3	10	8	3	10
23	C / 12 *a*	161-A. F.	Do.	Do.	Ditto ...	27th October 1919 ...	Ditto	2	4	14	8	25	4	8	38	8½
24	C / 13 *b*	Rosea Bhatla S.	Do.	Do.	Ditto ...	26th September 1919 ...	Ditto ...	2	16	9	9	32	13	9	32	13
25	C / 13 *a*	White flowered Neglectum Bhatla S.	Do	Do.	Ditto ...	Ditto ...	Ditto ...	2	37	6	13	31	9	13	31	9
26	C / 13 *b*	Narman of Pasina Kalan ...	Do.	Do.	Ditto ...	27th October 1919 ...	Ditto ...	2	17	13	9	37	14	11	32	8

Statement No. 4

SHOWING THE RESULT OF VARIETAL EXPERIMENT CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1919.

II Set.

Serial No.	Block and plot.	Name of variety.	Area sown in acre.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last packing.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Outturn per acre in terms of standard. Maunds.	Outturn per acre in terms of standard. Seers.	Outturn per acre in terms of standard. Chataks.	Remarks.
1	C / 1 *c*	Rosea Bhatla S.	59 / 240	59 / 240	8th April 1918 ...	26th September 1919 ...	19th December 1919 ...	1	37	14	7	36	12	7	36	12	Ploughings ... 5 Harrowings ... 5 Sohagings ... 3 Hoeings ... 6 Watering ... 4
2	C / 1 *d*	Narma of Pasina Kalan ...	Do.	Do.	Ditto ...	17th October 1919 ...	Ditto ...	0	36	10	3	29	0	6	34	3	
3	C / 2 *c*	Rosea Bhatla S.	Do.	Do.	Ditto ...	26th September 1919 ...	Ditto ...	1	16	15	5	31	10	5	31	10	
4	C / 2 *d*	161-A. F.	Do.	Do.	Ditto ...	27th October 1919 ...	Ditto ...	1	16	4	5	28	13	6	26	10½	
5	C / 3 *c*	Rosea Bhatla S.	Do.	1,145 / 4,840	Ditto ...	26th September 1919 ...	Ditto ...	1	31	6	7	21	11	7	21	11	
6	C / 3 *d*	275-F.	Do.	59 / 240	Ditto ...	27th October 1919 ...	Ditto ...	2	0	13	8	8	12	7	30	0	
7	C / 4 *c*	Rosea Bhatla S.	Do.	Do.	Ditto ...	26th September 1919 ...	Ditto ...	1	38	4	7	38	5	7	38	5	
8	C / 4 *d*	280-F.	Do.	1,124 / 4,840	Ditto ...	27th October 1919 ...	Ditto ...	2	10	12	9	30	12	8	14	9½	
9	C / 5 *c*	Rosea Bhatla S.	Do.	59 / 240	Ditto ...	26th September 1919 ...	Ditto ...	2	6	4	8	30	14	8	30	14	
10	C / 5 *d*	4-F.	Do.	Do.	Ditto ...	27th October 1919 ...	Ditto ...	1	6	4	4	28	2	7	15	11	

11	C / 6 c	Rosea Bhatla S.	...	...	Do.	Do.	Ditto	...	26th September 1919	...	Ditto	...	1	19	2	6	0	8	6	0	8
12	C / 6 d	Mollisonea 24	...	...	Do.	1,090 / 4,840	Ditto	...	Ditto	...	Ditto	...	1	26	2	7	13	10	7	16	11
13	C / 7 c	Rosea Bhatla S.	...	...	Do.	59 / 240	Ditto	...	Ditto	...	Ditto	...	2	6	12	8	32	14	8	32	14
14	C / 7 d	Rosea 87	...	...	Do.	1,160 / 4,840	Ditto	...	Ditto	...	Ditto	...	1	27	1	6	39	13	8	32	6
15	C / 8 c	Rosea Bhatla S.	...	...	Do.	59 / 240	Ditto	...	Ditto	...	Ditto	...	2	6	8	8	31	14	8	31	14
16	C / 8 d	Rosea 132	...	...	Do.	Do.	Ditto	...	Ditto	...	Ditto	...	2	14	10	9	24	15	7	33	3⅓
17	C / 9 c	Rosea Bhatla S.	...	...	Do.	Do.	Ditto	...	Ditto	...	Ditto	...	1	27	8	6	34	9	6	34	9
18	C / 9 d	Local Bhatla	...	...	Do.	Do.	Ditto	...	Ditto	...	Ditto	...	1	23	10	6	18	13	7	30	2½
19	C / 10 c	Rosea Bhatia S.	...	...	Do.	Do.	Ditto	...	Ditto	...	Ditto	...	2	5	0	8	25	12	8	25	12
20	C / 10 d	Indicum Yellow Flowered Bhatla S.			Do.	Do.	Ditto	...	Ditto	...	Ditto	...	1	28	12	6	39	11	8	32	0
21	C / 11 c	Rosea Bhatla S.	...	...	Do.	Do.	Ditto	...	Ditto	...	Ditto	...	2	8	1	8	38	4	8	38	4
22	C / 11 d	Neg. Yellow Fld. Bhatla S.			Do.	Do.	Ditto	...	Ditto	...	Ditto	...	2	7	2	8	34	7	9	34	5½
23	C / 12 c	Rosea Bhatla S.	...	...	Do.	Do.	Ditto	...	Ditto	...	Ditto	...	2	25	13	10	30	7	10	30	7
24	C / 12 d	Mollisonia Bhatla S.	...	...	Do.	Do.	Ditto	...	Ditto	...	Ditto	...	2	20	15	10	10	9	9	35	1½
25	C / 13 c	Rosea-74	...	...	Do.	Do.	Ditto	...	Ditto	...	Ditto	...	2	21	8	10	12	14	9	36	1½
26	C / 13 d	Rosea Bhatla S.	...	...	Do.	Do.	Ditto	...	Ditto	...	Ditto	...	2	8	15	9	1	12	9	1	12

Statement No. 5

SHOWING THE RESULTS OF SPACING EXPERIMENTS WITH COTTON CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Block and plot No.	Variety. Previous crop.	Area of plot in acres.	Area harvested in acres.	Spacing.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	A / 1 *a*	4-F American Toria ...	½	½	4 feet ...	20th March 1919 ...	9th October 1919 ...	20th December 1919 ...	4	20	8	9	1	0	Ploughings ... 5 Harrowings ... 5 Sohagings ... 9 Hoeings ... 4 Waterings ... 4
2	A / 1 *b*	Do. ... Do. ...	½	479 / 968	3½ feet ...	Ditto ...	Ditto ...	Ditto ...	5	3	11	10	11	10	
3	A / 2 *a*	Do. ... Do. ...	½	419 / 968	3 feet ...	Ditto ...	Ditto ...	Ditto ...	4	8	0	9	28	2	
4	A / 2 *b*	Do. ... Do. ...	½	1,619 / 3,960	2½ feet ...	Ditto ...	Ditto ...	Ditto ...	3	22	14	8	29	7	
5	A / 3 *a*	Do. ... Do. ...	½	3,209 / 7,260	4 feet ...	Ditto ...	Ditto ...	Ditto ...	4	35	15	11	3	5	
6	A / 3 *b*	Do. ... Do. ...	½	995 / 2,178	3½ feet ...	Ditto ...	Ditto ...	Ditto ...	4	15	13	9	24	14	
7	A / 4 *a*	Do. ... Do. ...	½	4,201 / 8,712	3 feet ...	Ditto ...	Ditto ...	Ditto ...	4	1	0	8	13	14	
8	A / 4 *b*	Do. ... Do. ...	½	471 / 968	2½ feet ...	Ditto ...	Ditto ...	Ditto ...	2	38	8	6	3	9	

Statement No. 6

SHOWING THE RESULTS OF SPACING EXPERIMENTS WITH COTTON CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Block and plot No.	Variety.	Previous crop.	Area sown in acres.	Area harvested.	Spacing.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	A / 19 *a*	White flowered Indicum Bhatia selected.	Wheat ...	½	229 / 484	2½ feet ...	27th April 1919 ...	27th September 1919	19th December 1919	2	21	9	5	14	10	Sohagings ... 2 Harrowing ... 1 Ploughing ... 1 Hoeings ... 4 Waterings ... 3
2	A / 19 *b*		Do. ...	½	2,101 / 4,840	2 feet ...	Ditto ...	Ditto ...	Ditto ...	3	6	3	7	10	11	
3	A / 20 *a*		Do. ...	½	115 / 242	1½ feet ...	Ditto ...	Ditto ...	Ditto ...	3	10	13	6	35	4	
4	A / 20 *b*		Do. ...	½	239 / 484	2½ feet ...	Ditto	Ditto ...	Ditto ...	3	17	11	6	38	13	
5	A / 21 *a*		Do. ...	½	241 / 484	2 feet ...	Ditto ...	Ditto ...	Ditto ...	3	20	2	7	1	7	
6	A / 21 *b*		Do. ...	½	½	1½ feet ...	Ditto ...	Ditto ...	Ditto ...	4	22	14	9	5	12	

Statement No. 7

SHOWING THE RESULTS OF DIFFERENT NUMBER OF HOEINGS WITH COTTON AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Block and plot.	Name of variety.	Treatment.	Area of plot in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	B / 1	White flowered Neg. lectum.	2 kasola hoeings ...	...	1 acre ...	30th April 1919 ...	27th September 1919	19th December 1919...	10	13	0	10	13	0	Ploughing ... 1 Harrowing ... 1 Sohagings ... 2 Hoeings ... 2, 3 and 4 in plots 1, 2 and 3, respectively. waterings ... 5
2	B / 2	Ditto	3 do. ...	...	Do. ...	Ditto ...	Ditto ...	Ditto ...	10	25	0	10	25	0	
3	B / 3	Ditto	4 do. ...	...	Do. ...	Ditto ...	Ditto ...	Ditto ...	10	34	1	10	34	1	

Statement No. 8

SHOWING THE RESULTS OF COTTON SOWN BROADCAST *VERSUS* IN LINES AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Block and plot.	Name of variety.	Treatment.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	B 3	Neglectum white flowered Bh. S.	Broadcast	1	1	30th April 1919 ...	27th September 1919	19th December 1919	10	34	1	10	34	1	Ploughing ... ... 1 Harrowing ... ... 1 Sohagings ... ... 2 Hoeings ... ... 4 Waterings 5
2	B 4	Ditto	In lines	1	1	28th April 1919 ...	Ditto ...	Ditto ...	9	39	6	9	39	6	

Statement No. 9

SHOWING THE RESULTS OF DIFFERENT METEODS OF HOEINGS WITH COTTCN DURING KHARIF 1919 AT THE AGRICULTURAL STATION, HANSI.

Serial No.	Block and plot No.	Name of variety.	Area sown in acres.	Treatment.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	B 4	White flowered Neglectum Bh. S.	1	Line sown 4 hoeings with kasola.	1	28th April 1919 ...	27th September 1919	19th December 1919	9	39	6	9	39	6	Sohagings 2 Ploughing 1 Harrowing 1 Waterings 5 Hoeings ... 3 Only 3 hoeings in each experiment could be given as the crop was too tall for the 4th hoeing and there would have been loss of fruit if the 4th one would have been done.
2	B 5		1	Line sown 4 hoeings with country plough.	1	Ditto ...	Ditto ...	Ditto ...	8	37	14	8	37	14	
3	B 6		1	Line sown 4 hoeings with Horse hoe.	1	Ditto ...	Ditto ...	Ditto ...	8	34	3	8	34	3	
4	B 7		1	Line sown 4 hoeings with Gujrat hoe.	1	Ditto ...	Ditto ...	Ditto ...	10	22	1	10	22	1	

Statement No. 10

SHOWING THE RESULTS OF DEEP AND SHALLOW CULTIVATION WITH COTTON EXPERIMENTS CARRIED OUT AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Name of variety.	Treatment.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	White flowered Indicum Bh. S. cotton.	Country plough	1	1	23rd April 1919 ...	27th September 1919	19th December 1919	8	33	1	8	33	1	
2		Rajah plough	1	1	Ditto ...	Ditto	Ditto	8	10	6	8	10	6	There was a bit of hard land where water remained stagnant: hence crop poor.
3		Sabul plough	1	1	Ditto ...	Ditto	Ditto	11	22	6	11	22	6	Ploughing ... ... 1 Harrowing ... ... 1 Sohagings ... ... 2 Hoeings ... ... 4 Waterings 5

Statement No. 11

SHOWING THE RESULTS OF EARLY AND LATE SOWING EXPERIMENTS WITH COTTON CONDUCTED AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Block and plot.	Name of variety.	Treatment.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
D 12 a	4-F.	Early sown in lines ...	½	½	2nd April 1919 ...	9th October 1919 ...	20th December 1919	7	24	11	15	9	6	Ploughings ... ... 5 Harrowings ... ... 6 Sohagings ... ... 7 Waterings ... ... 4 Hoeings 5
D 12 b	Rosea Bhatla selected (white flowered Neglectum Bh. S.).	Ditto ...	½	½	Ditto	8th October 1919 ...	Ditto	8	20	6	17	0	12	
D 13 a	4-F.	Late sown at 6 seers per acre ...	¼	¼	5th May 1919 ...	9th October 1919 ...	Ditto	3	3	12	12	15	0	
D 13 b	Rosea Bh. S.	Ditto ...	¼	¼	Ditto	8th October 1919 ...	Ditto	3	13	10	13	14	8	Ploughings ... ... 4 Harrowings ... ... 6 Sohagings ... ... 7 Hoeings ... ... 4 Waterings 4
D 13 c	4-F.	Late sown at 10 seers per acre	¼	¼	Ditto	9th October 1919 ...	Ditto	2	32	13	11	11	4	
D 13 d	Rosea Bh. S.	Ditto ...	¼	¼	Ditto	8th October 1919 ...	Ditto	2	37	7	11	29	12	

Statement No. 12

SHOWING THE RESULTS OF HYDRAULIC EXPERIMENTS CARRIED OUT AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Name of plot.	Variety.	Previous crop.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Treatment.	Remarks.
1	14 *a* 1	White flowared Neglectum Bh. S.	Gawara.	1/10	30th March 1919 ...	8th October 1919 ...	20th December 1919	0	15	4	3	32	8	5 waterings 1 hoeing ...	Ploughings ... 5 Harrowings ... 6 Sohagings ... 9
2	14 *a* 2	Ditto		1/10	Ditto ...	Ditto ...	Ditto ...	0	36	0	9	0	0	4 ditto 2 ditto,	
3	14 *a* 3	Ditto		1/10	Ditto ...	Ditto ...	Ditto ...	1	17	3	14	11	14	3 ditto 3 ditto.	
4	14 *a* 4	Ditto		1/10	Ditto ...	Ditto ...	Ditto ...	1	26	3	16	21	14	2 ditto 4 ditto.	
5	14 *a* 5	Ditto		1/10	Ditto ...	Ditto ...	Ditto ...	1	14	13	13	28	2	1 ditto 5 ditto.	
6	14 *b* 1	4-F. ...		1/10	Ditto ...	9th October 1919 ...	1st December 1919 ...	0	11	2	2	31	4	5 ditto 1 ditto.	
7	14 *b* 2	Do. ...		1/10	Ditto ...	Ditto ...	Ditto ...	0	37	2	9	11	4	4 ditto 2 ditto.	
8	14 *b* 3	Do. ...		1/10	Ditto ...	Ditto ...	Ditto ...	1	5	15	11	19	6	3 ditto 3 ditto.	
9	14 *b* 4	Do. ...		1/10	Ditto ...	Ditto ...	Ditto ...	1	7	3	11	31	4	2 ditto 4 ditto.	
10	14 *b* 5	Do. ...		1/10	Ditto ...	Ditto ...	Ditto ...	1	3	3	10	31	14	1 ditto 5 ditto.	
11	15 *a* 1	Mollisonea Bh. S. ...		1/10	Ditto ...	8th October 1919 ...	20th December 1919	0	35	7	8	34	6	5 ditto 1 ditto.	
12	15 *a* 2	Ditto ...		1/10	Ditto ...	Ditto ...	Ditto ...	1	7	0	11	30	0	4 ditto 2 ditto.	
13	15 *a* 3	Ditto ...		1/10	Ditto ...	Ditto ...	Ditto ...	1	13	15	13	19	6	3 ditto 3 ditto.	
14	15 *a* 4	Ditto ...		1/10	Ditto ...	Ditto ...	Ditto ...	1	28	6	17	3	12	2 ditto 4 ditto.	
15	15 *a* 5	Ditto ...		1/10	Ditto ...	Ditto ...	Ditto ...	1	23	13	15	38	2	1 ditto 5 ditto.	

Statement No. 13

SHOWING THE RESULTS OF ASHES *VERSUS* NO ASH EXPERIMENTS WITH COTTON CARRIED OUT AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Block and plot.	Name of variety.	Treatment.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	D / 15 b 1	4-F. ...	No ash ...	1/4	1/4	7th March 1919 ...	9th October 1919 ...	20th December 1919	2	1	10	8	6	8	Ploughings ... 2 Harrowings ... 2 Sohagings ... 4 Hoeings ... 4 Waterings ... 4
2	D / 16 c	Do. ...	Sticks standing ...	1/4	1/4	Ditto ...	Ditto ...	Ditto ...	1	31	13	7	7	4	
3	D / 16 a	Do. ...	Organic matter ...	1/4	1/4	Ditto ...	Ditto ...	Ditto ...	1	26	7	6	25	12	
4	D / 17 c	Do. ...	Ashes ...	1/4	1/4	Ditto ...	Ditto ...	Ditto ...	1	4	7	4	17	12	
5	D / 17 d	Do. ...	No ash ...	1/4	1/4	Ditto ...	Ditto ...	Ditto ...	0	39	9	3	38	4	
6	D / 15 b 2	White flowered Indicum Bh. S.	Ditto ...	1/4	1/4	Ditto ...	6th October 1919 ...	Ditto ...	1	22	4	6	9	0	
7	D / 16 b	Ditto	Sticks standing ...	1/4	1/4	Ditto ...	Ditto ...	Ditto ...	0	39	12	3	39	0	
8	D / 16 a	Ditto	Organic matter	1/4	1/4	Ditto ...	Ditto ...	Ditto ...	0	39	8	3	38	0	
9	D / 17 b	Ditto	Ashes ...	1/4	1/4	Ditto ...	Ditto ...	Ditto ...	1	18	7	5	33	12	
10	D / 17 a	Ditto	No ash ...	1/4	1/4	Ditto ...	27th September 1919	Ditto ...	1	2	13	4	11	4	

Statement No. 14

SHOWING THE RESULTS OF PERMANENT COTTON PLOT GROWN AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Block and plot.	Name of variety.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Outturn per acre, 1918. Maunds.	Outturn per acre, 1918. Seers.	Outturn per acre, 1918. Chataks.	Outturn per acre, 1917. Maunds.	Outturn per acre, 1917. Seers.	Outturn per acre, 1917. Chataks.	Outturn per acre, 1916. Maunds.	Outturn per acre, 1916. Seers.	Outturn per acre, 1916. Chataks.	Outturn per acre, 1915. Maunds.	Outturn per acre, 1915. Seers.	Outturn per acre, 1915. Chataks.	Remarks.
D/18	Local Bhatla	1	1	16th March 1919 ...	27th September 1919	20th December 1919	5	8	5	5	8	5	7	26	9	1	30	1	10	9	0	11	22	10	Ploughings ... 4 Harrowings ... 5 Sohagings ... 3 Hoeings ... 3 Waterings ... 4

Statement No. 15

SHOWING THE RESULTS OF BARANI COTTON EXPERIMENT CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Block and plot.	Variety.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking	Date of Last picking.	Actual outturn. Maunds	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	E/2	Local Bhatla	1	1	18th July 1919 ...	19th November 1919	31st January 1920 ...	2	2	11	2	2	11	Ploughings ... 2 Harrowings ... 2 Sohaging ... 1 Hoeings ... 2 } Crop was very poor.
2	E/5a	Ditto	½	19/40	Ditto ...	Ditto	Ditto ...	3	14	6	7	2	14	Ploughings ... 2 Harrowings ... 3 Sohagings ... 2 Hoeings ... 2
3	E/5b	Ditto	½	5/12	Ditto ...	Ditto	Ditto ...	1	20	13	3	25	15	

NOTE.—In E/5a plot of ½ acre in area ½" layer of sand was applied in March 1919. The weight of sand applied was 2.144 maunds.

Statement No. 16

SHOWING THE RESULTS OF THINNING EXPERIMENT OF COTTON CARRIED OUT AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Serial No.	Field and p'ot	Variety.	Treatment.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	27 / B 1	White flowered Neglectum Bh. S. (Rosea Bh. S.)	Thinning when 1 foot high.	¼	24th April 1919 ...	27th September 1919	21st December 1919	2	34	7	11	17	12	Ploughings 2 Harrowings 3
2	27 / B 2		Thinning when 2 feet high.	¼	Ditto ...	Ditto	Ditto	1	31	11	7	6	12	Sohagings 5 Hoeings 3
3	27 / B 3		Thinning when 3 feet high.	¼	Ditto ...	Ditto	Ditto	1	18	7	5	33	12	Waterings 4

Statement No. 17

SHOWING THE RESULTS OF COTTON VARIETIES FOR ENVIRONMENT EXPERIMENT OF THE ECONOMIC BOTANIST, PUNJAB, GROWN AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Bloc and plot.	Variety.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
Field No. 29 ...	Indicum 133-L. ...	96 / 605	844 / 5415	3rd April 1919 ...	27th September 1919	21st December 1919	0	26	0	4	7	11	Ploughings ... 4 Harrowings ... 2
Ditto ...	193-F. ...	96 / 605	277 / 1815	Ditto ...	19th October 1919 ...	Ditto	0	14	4	2	13	7	Sohagings ... 4 Hoeings ... 3
Ditto ...	Multani ...	96 / 605	1121 / 7260	Ditto ...	27th September 1919	Ditto	1	6	1	7	12	12	Waterings ... 3

Statement No, 18

SHOWING THE RESULTS OF WHEAT VARIETIES SOWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

I Set.

Block	Plot.	Name of type.	Previous crop.	Date of Sowing.	Date of Harvesting.	Area harvested in acres.	Actual outturn. Grain. Maunds.	Actual outturn. Grain. Seers.	Actual outturn. Bhusa. Maunds.	Actual outturn. Bhusa. Seers.	Outturn per acre. Grain. Maunds.	Outturn per acre. Grain. Seers.	Outturn per acre. Bhusa. Maunds.	Outturn per acre. Bhusa. Seers	Outturn per acre in terms of standard. Grain. Maunds.	Outturn per acre in terms of standard. Grain. Seers.	Outturn per acre in terms of standard. Bhusa. Maunds.	Outturn per acre in terms of standard. Bhusa. Seers.	Area lodged in square yards.	Remarks.	
A	9—10	Punjab 14 ...	4-F cotton	15th November 1919	13th April 1920 ...	1/10	2	6½	3	32½	21	25	38	5	21	25	38	5	13·3	Ploughings	5
	1 9—10	8-A. ...	Ditto ...	Ditto ...	15th April 1920 ...	1/10	2	37½	4	29	29	15	47	10	24	27½	42	15	...	Harrowings	2
	2 9—10	Punjab 14 ...	Ditto ...	Ditto	18th April 1920 ...	1/10	2	31	4	26½	27	30	46	25	27	30	46	25	6·6	Sohagirgs	6
	3 9—10	8-B. ...	Ditto ...	Ditto ...	13th April 1920 ...	1/10	2	9½	4	11½	22	15	42	35	27	22½	46	35	...	Hoeing	1
	4 9—10	Punjab 14 ...	Ditto ...	Ditto ...	13th April 1920 ...	1/10	2	29½	4	28½	27	15	47	5	27	15	47	5	...	Waterings	3
	5 9—10	9-C. ...	Ditto ...	Ditto ...	12th April 1920 ...	1/10	2	31	4	23	27	30	45	30	26	10	44	5	...		
	6 9—10	Punjab 14 ...	Ditto ...	Ditto ...	13th April 1920 ...	1/10	2	20½	4	4½	25	5	41	5	25	5	41	5	...		
	7 9—10	17-B. ...	Ditto ...	Ditto ...	12th April 1920 ...	1/10	2	24¾	5	9¾	26	7½	52	17½	27	12½	43	10	...		
	8 9—10	Punjab 14 ...	Ditto ...	Ditto ...	13th April 1920 ...	1/10	2	38	4	21½	29	20	45	15	29	20	45	15	...		
	9 9—10	20-C. ...	Ditto ...	Ditto ...	12th April 1920 ...	1/10	2	27	4	39½	26	30	49	35	29	15	50	7½	22·2		
	10 9—10	Punjab 14 ...	Ditto ...	Ditto ...	13th April 1920 ...	1/10	2	37	5	20	29	10	50	0	29	10	50	0	42·0		
	11 9—10	Punjab 11 ...	Ditto ...	Ditto ...	14th April 1920 ...	1/10	3	2½	4	33½	30	25	48	15	28	8¾	50	23⅜	2·0		
	12 9—10	Punjab 14 ...	Ditto ...	Ditto ...	14th April 1920 ...	1/10	2	28¾	4	24¾	27	7½	46	7½	27	7½	46	7½	22·2		
	13 9—10	Punjab 17 ...	Ditto ...	Ditto ...	12th April 1920 ...	1/10	2	30½	4	30½	27	25	47	25	29	18⅝	50	22½	16·6		
	14 9—10	Punjab 14 ...	Ditto ...	Ditto ...	14th April 1920 ...	353/3,630	2	34⅜	5	19¾	31	29¾	54	37½	31	29¾	54	37½	34·4		
	15 9—10	Pusa 12 ...	Ditto ...	Ditto ...	10th April 1920 ...	1/10	2	17½	4	13½	24	15	43	15	27	39⅞	53	38¾	...		
	16 9—10	Punjab 14 ...	Ditto ...	Ditto ...	14th April 1920 ...	1/10	2	17	5	12	24	10	53	0	24	10	53	0	11·5		
	17																				

Statement No. 18 (II)

SHOWING THE RESULTS OF VARIETAL TEST OF WHEAT CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

II Set.

Block and plot.		Name of type.	Previous crop.	Date of		Area harvested in acres.	Actual outturn.				Outturn per acre.				Outturn per acre in terms of standard.				Area lodged in square yards.	Remarks.
							Grain.		*Bhusa.*		*Grain.*		*Bhusa*		*Grain.*		*Bhusa.*			
Block.	Plot.			Sowing.	Harvesting.		Maunds	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	See s.	Maunds.	Seers.	Maunds.	Seers.		
A	11 –12 / 1	Punjab 14 ..	4-F. cotton	15th November 1919	12th April 1920 ...	1/10	1	27½	2	20½	16	35	25	25	16	35	25	5	...	
	11—12 / 2	Pusa 12 ...	Ditto ...	Ditto ...	10th April 1920 ...	1/10	1	27½	2	2?¼	16	35	27	5	19	32½	30	27½	...	
	11—12 / 3	Punjab 14 ...	Ditto ...	Ditto ...	12th April 1920 ...	1/10	2	11	3	25	22	30	36	10	22	30	33	10	53·3	
	11—12 / 4	Punjab 17 ...	Ditto ...	Ditto ...	Ditto ...	1/10	2	11½	3	28½	22	35	37	5	22	5	34	0	...	
	11—12 / 5	Punjab 14 ...	Ditto ...	Ditto ...	13th April 1920 ...	1/10	2	6	3	7	21	20	31	30	21	20	31	30	...	
	11 –12 / 6	Punjab 11 ...	Ditto ...	Ditto ...	Ditto ...	1/10	2	26	3	25½	26	20	36	15	24	23¾	38	11¼	...	
	11—12 / 7	Punjab 14 ...	Ditto ...	Ditto ...	Ditto ...	1/10	2	30¾	4	19¼	27	27½	44	32½	27	27½	44	32½	20·7	
	11—12 / 8	20-C ...	Ditto ..	Ditto ...	12th April 1920 ...	1/10	2	27	5	6½	26	30	51	15	28	18¾	49	16¼	44·4	
	11—12 / 9	Punjab 14 ...	Ditto ...	Ditto ...	13th April 1920 ...	1/10	2	37	5	16	29	10	54	0	29	10	54	0	80·6	
	11—12 / 10	17-B ...	Ditto ...	Ditto ...	12th April 1920 ...	1/10	2	14	4	34	23	20	48	20	29	25	53	35	...	
	11—12 / 11	Punjab 14 ...	Ditto ...	Ditto ...	14th April 1920 ...	1/10	3	0	5	15	30	0	53	30	30	0	53	30	...	
	11—12 / 12	9-C ...	Ditto ...	Ditto ...	17th April 1920 ...	1/10	3	3	5	18½	30	30	74	25	29	32½	45	22½	259·3	
	11—12 / 13	Punjab 14 ...	Ditto ...	Ditto ...	15th April 1920 ...	1/10	2	38½	3	29½	20	25	37	15	29	25	37	15	218·0	
	11—12 / 14	8-B ...	Ditto ...	Ditto ...	13th April 1920 ...	1/10	2	29	5	34	27	10	58	20	30	37½	55	37½	103·5	
	11—12 / 15	Punjab 14 ...	Ditto ...	Ditto ...	15th April 1920 ...	1/10	3	9	17	18	32	10	74	20	32	10	74	20	249·0	
	11—12 / 16	8-A ...	Ditto ...	Ditto ...	17th April 1920 ...	1/10	3	5	8	27	31	10	86	30	30	35	72	5	203·3	
	11—12 / 17	Punjab 14 ...	Ditto ...	Ditto ...	14th April 1920 ...	1/10	2	38	6	39	29	20	69	30	29	20	69	30	214·4	

Statement No. 18-A

SHOWING THE RESULTS OF VARIETAL TEST OF WHEAT EXPERIMENT IN TENANTS' AREA GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

Serial No.	Field and plot.	Name of type.	Date of Sowing.	Date of Harvesting.	Area harvested in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Remarks.
1	$\frac{7}{4}$ & 8	8-A. ...	18th to 20th November 1919.	16th to 24th April 1920 ...	2	61	39	8	133	34	8	30	39	12	66	37	4	Ploughings ... ... 3 Harrowing 1
2	$\frac{7}{5}$ & 8	Punjab 11 ...	Ditto	Ditto ...	2	56	16	0	102	17	0	28	8	0	51	8	8	Sohagings ... ... 2 Waterings 4
3	$\frac{7}{5}$ & 8	Punjab 14 ...	Ditto	Ditto ...	$2\frac{1}{2}$	56	23	8	107	26	8	27	26	10	52	25	5	Hoeing 1

Statement No. 18-B

SHOWING THE RESULTS OF VARIETAL TEST OF WHEAT EXPERIMENT IN TENANTS' AREA AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

Serial No.	Field and plot.	Name of type.	Area harvested in acres.	Date of Sowing.	Date of Harvesting.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Remarks.
1	11 & 12	8-A. ...	2	18th to 20th November 1919.	14th to 21st April 1920 ...	52	1	0	80	39	0	26	0	8	40	19	8	Ploughings ... ... 3 Harrowing 1
2	11 & 12	Punjab 11 ...	2	Ditto	Ditto	51	10	0	74	19	0	25	25	0	37	9	8	Sohagings ... ... 2 Hoeing 1
3	11 & 12	Punjab 14 ...	2	Ditto	Ditto ...	49	12	11	84	26	5	24	26	5	42	13	3	Waterings 3
1	10	Punjab 14 ...	$1\frac{23}{16}$	22nd November 1919 ...	8th to 15th April 1920 ...	24	20	10	36	10	6	18	17	3	26	35	8	Ploughings ... ... 3 Harrowing 2
2	10	9-C. ...	$1\frac{23}{16}$	Ditto ...	Ditto ...	24	3	0	39	13	0	17	34	2	29	6	8	Sohagings ... ... 2 Hoeing ... ... 1 Waterings 3

Statement No. 18-C

SHOWING THE RESULTS OF VARIETAL TEST OF WHEAT EXPERIMENT IN TENANTS' AREA GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

Serial No.	Field and plot.	Name of type.	Area harvested in acres.	Date of		Actual outturn.						Outturn per acre.						Remarks.
				Sowing.	Harvesting.	*Grain.*			*Bhusa.*			*Grain.*			*Bhusa.*			
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
1	3	Punjab 11	2½	8th-9th December 1919.	25th to 28th April 1920	59	10	0	97	0	0	23	28	0	38	32	0	Ploughings ... 3 Harrowing ... 0 Sohaging ... 1 Waterings ... 3 Hoeing ... 1
2	3	Punjab 14	2½	Ditto	Ditto	57	13	4	114	39	12	22	37	5	45	39	14	

Statement No. 18-D

SHOWING THE RESULTS OF VARIETAL TEST OF WHEAT EXPERIMENT IN TENANTS' AREA GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

Serial No.	Field and plot.	Name of variety.	Date of		Area harvested in acres.	Actual outturn.						Outturn per acre.						Remarks.
			Sowing.	Harvesting.		*Grain.*			*Bhusa.*			*Grain.*			*Bhusa.*			
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
1	4	8-A.	17th-18th November 1919.	17th-18th April 1920	½	11	3	8	27	6	8	22	7	0	54	13	0	Crop was poor in one of the sub-plots under it.
2	4	Punjab 11	Ditto	Ditto	½	12	27	0	34	34	0	25	14	0	69	28	0	Ploughings ... 3 Harrowing ... 1 Sohagings ... 2 Waterings ... 4 Hoeing ... 1
1	9	Punjab 14	16th November 1919	14th to 16th April 1920	1·329	28	7	8	64	15	8	21	8	6	48	17	15	Ploughings ... 2 Harrowings ... 2 Sohagings ... 3 Waterings ... 4 Hoeing ... 1

Statement No. 19

SHOWING THE RESULTS OF DEEP AND SHALLOW CULTIVATION ON WHEAT GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

Block and plot.	Name of type.	Treatment.	Area harvested in acres.	Actual outturn.				Outturn per acre.				Area lodged in square yards.	Remarks.
				Grain.		*Bhusa.*		*Grain.*		*Bhusa.*			
				Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.		
D/8	8-A.	Country plough ...	602/605	26	35	46	26	27	5/19	46	35 5/19	21 sq. yds.	Ploughings ... ... 5 Harrowings ... ... 3 Sohagings ... .. 7 Hoeings ... ... 2 Waterings ... .. 4 Date of sowing—19th November 1919. Date of harvesting—17th to 21st April 1920.
D/9	8-A.	Rajah plough 4½" deep ...	483/484	30	16¼	54	19¾	30	18¾	54	24¼	¼ acre	
D/10	8-A.	Sabul plough 9" deep ...	483/484	30	18⅜	56	13⅜	30	21⅞	56	19 15/16	⅜ acre	

Statement No. 20

SHOWING THE RESULTS OF WHEAT AFTER WHEAT EXPERIMENT CONDUCTED AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

Block and plot.	Name of type.	Area sown in acres.	Area harvested in acres.	Actual outturn.			Outturn per acre.													Remarks.
							1919-20.			1918-19.			1917-18.			1916-17.			1915-16.			
				Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
E/17	Punjab 14	1	114/121	14	18	8	15	14	0	19	10	0	22	20	0	30	20	0	...	...	...	Ploughings ... 4 Harrowing ... 2 Sohagings ... 5 Hoeings ... 4 Waterings ... 4 Date of sowing—17th November 1919. Date of harvesting—20th April 1920.
...	Bhusa	23	...	23	32	0	25	10	7	...	...	...	...	...	...	...	...	...	...	...	...	

Statement No. 21

SHOWING THE RESULTS OF VARIETAL TEST EXPERIMENT WITH SUGARCANE VARIETIES AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Block and plot.	Treatment before sowing.	Name of variety.	Area sown in acres.	Area harvested in acres.	Actual outturn.								Outturn per acre.						Percentage of juice to canes.	Percentage of gur to juice.	Percentage of gur to canes.	Remarks.
					Unstripped canes.		*Tops.*		*Canes.*		*Juice.*		*Gur.*		*Canes.*		*Juice.*		*Gur.*					
					Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.				
A / 16 *b*	Farm yard manure applied at the rate of 15 tons per acre.	Local ...	¼	¼	138	17	27	3½	90	28⅛	52	33	9	7	262	34	211	12	36	28	58·23	17·36	10·11	Ploughings ... 8
A / 16 *a*		Suretha ...	¼	1099 / 4240	118	17½	19	½	77	3	48	30	8	4⅛	339	4	214	27¹³/₁₆	35	27⁷/₁₆	63·25	16·62	10·51	Harrowings ... 8
A / 17 *b*		Lalri ...	¼	557 / 2420	160	23¼	22	31⅛	94	13	47	30	8	28¼	409	32⁹/₁₆	207	13⅜	37	33	50·62	18·23	9·23	Sohagings ... 17 Hoeings ... 14
A / 17 *a*		Mango ...	¼	¼	188	9½	26	½	124	12½	70	37	12	26⅜	497	10	283	28	50	25½	57·05	17·85	10·17	Waterings ... 11
A / 18 *b*		Behar ...	¼	51 / 1210	19	14	2	34	11	20	7	10	1	9¼	272	33¹¹/₁₆	172	⁶/₁₆	28	12⅛	63·01	16·29	10·27	Date of sowing—10th, 11th March 1919.
A / 18 *a*		Local ...	¼	¼	110	9½	13	29½	77	31½	43	17	8	15¼	311	18	175	28	33	21	55·77	19·30	10·76	
A / 16 *c*		Do. ...	¼	¼	157	1	24	1½	102	28	61	9	10	15	410	32	244	36	41	20	59·61	16·94	10·10	
A / 16 d_1		J. 105 *a* ...	1/12	...	6	25½	1	5	2	29½	1	36	0	11	...	...	...	...	...	...	69·40	14·47	10·04	
A / 16 d_2		Behar ...	1/12	913 / 14520	34	13	6	8	22	21	13	38	2	10	358	9⅛	221	31³/₁₆	35	31⁵/₁₆	61·93	16·13	9·99	
A / 16 d_3		Dhaura ...	1/12	551 / 7260	41	23½	7	7	25	11	14	14	2	10½	333	1	189	3	29	32⁷/₁₆	56·78	15·77	8·95	
A / 17 *c*		Mango ...	½	557 / 2420	138	30½	22	24	93	1	52	30½	9	17½	404	6⅝	229	9⁵/₁₆	41	¹/₁₆	56·72	17·89	10·15	
A / 17 *d*		Lalri ...	¼	263 / 1089	130	7⅜	15	2	83	5¼	47	0	9	10	344	8¾	194	24½	38	12¹/₁₆	56·43	19·70	11·13	
A / 18 *c*		Suretha ...	¼	31 / 132	96	9½	10	8	58	1½	35	32	6	11	247	5	152	17⅞	26	28³/₁₆	61·63	17·52	10·81	
A / 18 *d*		Local ...	¼	113 / 726	84	2½	13	15¼	55	38	31	0	6	1	359	18⅝	200	31	38	28⅜	55·85	19·28	10·77	

N.B.—Out of whole plot of J. 105 good canes were kept for seed only, the lodged and bad ones were crushed; hence no definite results or area can be ascertained.

Statement No. 22

SHOWING THE RESULTS OF COMPARATIVE TEST OF BARLEY TYPES GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

Serial No.	Block and plot.	Name of type.	Date of sowing.	Date of harvesting.	Area sown in acres.	Area harvested in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Remarks.
1	Field 24/a	Local barley	11th November 1919	30th March 1920	1/8	1/8	2	32	3	13	14	0	16	25	Ploughings ... 2
2		Type No. I	Ditto	Ditto	1/8	1/8 193/968	4	5½	5	9	20	27½	26	5	Sohagings ... 4
3		Local barley	Ditto	28th March 1920	1/8		4	39	6	7	24	38	30	38½	Harrowing ... 1
4		Type No. II	Ditto	30th March 1920	1/8	1/8	5	21½	6	32	27	28¾	34	0	Waterings ... 2
5		Local barley	Ditto	27th-28th March 1920	1/8	1/8	5	13	6	24	26	25	33	0	
6		Type No. IV	Ditto	27th March 1920	1/8	1/8	6	1⅞	7	28	30	9¾	38	20	
7		Local barley	Ditto	26th March 1920	1/8	1/8	6	4½	6	10	25	22½	31	20	
8		Type No. V	Ditto	30th March 1920	1/8	1/8 21/110	6	3	7	38	31	32½	41	25 9/16	
9		Local barley	Ditto	25th March 1920	1/8	953/4840	5	17	6	20	27	22	33	½	

Statement No. 22-A

SHOWING THE RESULTS OF COMPARATIVE TEST OF BARLEY TYPES GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20, ON TENANTS' AREA.

Serial No.	Block and plot.	Name of type.	Date of sowing.	Date of harvesting.	Area sown in acres.	Area harvested in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Remarks.
1	Field No. 7/1	Type No. I	17th October 1919	4th-5th April 1920	1	597/605	17	14	7	21	7	0	17	23	7	21	18	3	Ploughings ... 3
2	Field No. 7/2	Type No. II	Ditto	30th March 1920 and 4th April 1920.	65/66	65/66	18	3	8	28	38	0	18	14	6	29	5	8	Harrowing ... 1 Sohagings ... 2
3	Field No. 7/3	Type No. IV	18th October 1919	26th to 29th March 1920.	1	1	21	16	3	27	4	0	21	16	3	27	4	0	Waterings ... 3
4	Field No. 7/4	Type No. V	Ditto	29th March to 6th April 1920.	1	1	20	23	8	23	26	0	20	23	8	23	26	0	

Statement No. 23

SHOWING THE RESULTS OF COMPARATIVE TEST OF GRAM VARIETIES GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

Serial No.	Name of block and plot.	Name of type.	Date of sowing.	Date of harvesting.	Area sown in acres.	Area harvested in acres.	Actual outturn. *Grain.* Maunds.	Actual outturn. *Grain.* Seers.	Actual outturn. *Bhusa.* Maunds.	Actual outturn. *Bhusa.* Seers.	Outturn per acre. *Grain.* Maunds.	Outturn per acre. *Grain.* Seers.	Outturn per acre. *Bhusa.* Maunds.	Outturn per acre. *Bhusa.* Seers.	Remarks.
1		Local gram	6th October 1919 ...	7th April 1920 ...		225	0	20	0	22	8	24	9	19	Ploughings 3
2		Type No. 7	Ditto ...	Ditto ...		3872 117	0	32¼	0	28¾	13	14	11	37	Harrowings 2
3		Local gram	Ditto ...	Ditto ...		1936 39	0	17½	0	14½	7	36	6	21	Sohaging 1
4		Type No. 15	Ditto ...	Ditto ...		704 945	0	20½	0	16¼	8	16	6	34½	Watering 1
5		Local gram	Ditto ...	Ditto ...		15488 387	0	11	0	10	11	¼	10	3/16	
6		Type No. 17	Ditto ...	Ditto ...		15488 885	0	10	0	11	3	¾	3	13	
7	D	Local gram	Ditto ...	Ditto ...	1	10388 213	0	17	0	13	7	29	5	36	
8	11	Type No. 20	Ditto ...	Ditto ...	16	3872 855	0	16½	0	14½	7	18¾	6	22¼	
9		Local gram	Ditto ...	Ditto ...		15488 105	0	24½	0	18¾	10	10	7	38	
10		White Burma No. I	Ditto ...	Ditto ...		1776 915	0	22½	0	27⅜	9	16½	11	30	
11		Local gram	Ditto ...	Ditto ...		15488 948	0	39½	0	33⅜	16	3	13	21½	
12		White Burma No. II	Ditto ...	Ditto ...		15488 477	0	20½	0	25½	8	13	10	14	
13		Local gram	Ditto ...	Ditto ...		7744 219	0	20¼	0	18¾	8	38	8	11	
14		Black Burma	Ditto ...	Ditto ...		3872 63	0	½	0	½	0	30¾	0	30¾	
15		Local gram	Ditto ...	Ditto ...		3872 357 15488	0	3½	0	3½	3	21	4	2¾	

Statement No. 24

SHOWING THE COMPARATIVE RESULTS OF MUSTARD VARIETIES GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1919-20.

Serial No.	Name of field.	Name of variety	Area sown.	Area harvested in acres.	Date of Sowing.	Date of Harvesting.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	Remarks.
1	24	Brown mustard	⅓ acre	4·5 / 1452	11th November 1919	7th April 1920 ...	0	19	4	1	18	14	Ploughings 3 Harrowing 1 Sohagings 4 Waterings 2
2		Local „		1183 / 3630	Ditto	31st March 1920 ...	2	15	0	7	11	8	
3		Yellow „		1189 / 3620	Ditto	7th April 1920 ..	0	26	12	2	1	10	

Statement No. 25

SHOWING THE RESULTS OF OUTTURN OF EXPERIMENTS OF NAHRI BAJRA GROWN AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Block and plot.	Variety.	Area harvested in acres.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	Remarks.
E 16a	Local bajra	½	2	[illegible]	8	5	31	0	Ploughings ... ... 2 Harrowing ... ... 1 Sohagings ... ... 4 Waterings ... ... 2 Hoeing ... ... 1 Date of sowing—16th July 1919. Date of harvesting—14th October 1919 and 20th October 1919 for *a* and *b*, respectively.
E 16b	Australian bajra		2	[illegible]	6	5	30	0	

Statement No. 26

SHOWING THE RESULTS OF BARANI EXPERIMENT OF BAJRA GROWN AT HANSI AGRICULTURAL STATION DURING KHARIF 1919.

Block and plot.	Variety.	Area harvested in acres.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	Remarks.
E 7a	Australian bajra	½	3	0	0	6	0	0	Ploughings ... ... 2 Harrowings ... ... 2 Sohagings ... ... 2 Hoeing ... ... 1 Date of sowing—20th July 1919. Date of harvesting—15th October 1919 and 14th October 1919 for *a* and *b*, respectively.
E 7b	Local bajra		5	5	0	10	10	0	

Experiments in Economic Botany by the Economic Botanist to Government, Punjab.

Introduction.—I took over charge of the office of the Economic Botanist to Government Punjab, from Mr. Milne on 4th June 1920, when he proceeded on combined leave.

Chaudhri Ali Muhammad, L. Ag., has been appointed officiating Assistant Professor of Botany in my place.

Lala Bansi Lal, L. Ag., has been appointed Demonstrator for College work instead of Lala Ishar Das, L. Ag., who resigned his post.

M. Sardar Khan, who passed the Diploma Examination this year, has been awarded the research scholarship which is tenable for two years. He will work on Rice and its cultivation and will receive his training under the Economic Botanists of Bengal, Madras, and Bombay.

Cottons.—Experimental cottons were grown on 18 acres of land as in the last year. Ten acres comprised plots Nos. 11, 12, 17 and 18 in squares Nos. 28 and 46 in the old area and 8 acres consisted of plots Nos. 5, 6, 7 and 8 of square No. 31 in the new area. Plots Nos. 6 and 7 are sandy, and the soil of the rest of the plots is good loam.

Fifty-five main selections of American cottons and 75 of Desis were grown interstripped in long, narrow rows as before. In addition to these 170 selections and crosses of cottons including both Desi and American were grown for trial. All selections were sown during the second-half of April 1919, which is the usual time for the zamindars of the colony to sow cottons. The year 1919 has turned out to be a very poor one for the cotton crop and complaints regarding the state of the crop were heard from many farmers. A report on the probable causes of the complaints has already been submitted to the Director of Agriculture and it will suffice to give a brief *résumé* of it here.

Complaints from Farmers.—Many farmers in the Lyallpur, Sargodha, Jhang, Multan, and Montgomery Districts complained that in the month of "Assu" (15th September to 15th October) their cotton plants, Desi and American, dropped many of their flowers and young bolls. Later, farmers complained that first pickings were very late; that when they were got, the bolls did not open properly, especially in the case of American cottons, and that in American cottons the lint was trash, the seeds were not properly developed, and the leaves turned yellow. They also stated that in Desi cottons the qualities of the lint and the seeds were less affected than in the case of Americans, and that the Desi leaves did not turn yellow. Some farmers stated that their losses in the case of Desi cottons were ruinous, however.

An enquiry was made as to the cause of the trouble. It was suggested by both farmers and traders that bollworm was the cause of the trouble, but investigations showed that neither bollworm nor other insect or fungus pests were the factors. There is a general belief in the cotton trade that cause of the trouble was deterioration of 4-F, but this was not the cause of the sudden widespread and serious nature of the complaints for—

(*A*) Cases were found where several fields of 4-F sown from the same consignment of seed were growing alongside each other and where the crop in some of the fields or portion of the fields was severely affected while on the others it was not affected.

(*B*) Desi cottons were also ruinously affected in some cases.

The areas of the Province much affected were south-west of a line running from about Phullarwan Railway Station (on the Malakwal-Shorkot Railway) through Sangla, Jaranwala, Pattoki, and Muktsar to Hissar. This line runs fairly parallel to and not far south of the line of 15 inches normal rainfall; in other words, the damage was only bad in the drier parts of the Province.

Even in the badly-affected localities the crop, both Desi and American, was good where extra irrigation water had been given or the soil was more retentive of water. From data collected the history of the trouble briefly appears to be as follows:—

In affected areas the season was very dry and hot till about the 20th of July and plants were somewhat stunted in growth till then. Between that and the 1st of September humidities were high, rains fell, and the plants grew with extraordinary rapidity. This soft luxuriant vegetative growth was then suddenly plunged into severely dry and hot condition, which it was ill-suited to stand and which continued through September and October. In these months the plants are not in full leaf but they have to produce the greater part of their flowers, and develop a large part of their fruits; hence their demands for water are greater than at any other time of the year and apparently in 1919 they could not meet this demand.

It seems to me that a daily record of seasons humidities from the Meteorological Department might serve as a useful guide to the Irrigation Department, to farmers, and all of us as to the water requirements of cotton crop. Other points of interest in connection with cotton-growing in the Punjab have come out in the enquiry, for example, the question of the limit of intensity of cropping in the months of September-October, etc., etc., but I will only mention

here that if the cultivation of American cottons is to be remunerative to zamindars and irrigation water is to be sold by volume these cottons are so much less drought resistant than Desis that care will have to be taken to make the price per unit of water only such as will induce zamindars to avoid wasting it and not enough to make it more profitable for them to grow Desi cottons.

A comparison of the results got from the various cotton plots in the Botanical Experimental Area show that American cottons there did best when they were watered at least twice in September, twice in October, and once in November. A watering was given in December in some cases also. I have shown a few examples of these results in statement A appended.

The trouble complained of by farmers started in September, and I have given in the statement a record of waterings from 1st September onwards.

The plants with a scarce water-supply in September and October shed many of the flowers, opened buds and young bolls. This naturally reduced the crop got from these plants (*cf.* cases against square plot 31/5-b, 31/6c, 31/7A, 28/17A, statement A). The bolls that remained on the plants did not grow to normal size, they opened badly, their lint was so weak and irregular that it could only be described as trash and the seeds were so undeveloped that they were practically useless for sowing purposes. The trouble was accentuated on what is described as sandy land (see square plot 31/6c and 31/7A, statement A), *i.e.*, land in which both soil and sub-soil are sandy. One would expect this as the water holding capacity of such lands is comparatively poor. The trouble was also very marked in what is referred to in statement A as compact lands. These lands are so hard that water does not penetrate freely into them. We have seen that just after irrigation water disappears from the surface of some of these hard patches in the Botanical area, the soil at 15 inches depth appears quite dry to the touch. The bolls of cotton on such patches usually open poorly in any year and their lint is always bad. On patches of fair quality of loam unmanured during the past dozen years but watered twice in September, twice in October, and once in November American cotton has given a normal crop of 9 to 10 maunds of Kapas per acre. (See square plot 28/17-A, statement A). The bolls opened well and the lint was good. On better land with similar watering in September-October the yield of American cottons went up to over 15 maunds of Kapas per acre.

As regards selected Desi types growing in the Botanical Area it will be seen from statement A that these types gave quite good crops on sandy lands where Americans gave very little (*cf.* Square plot No. 31/6c and 31/6b, 31/7-A, 31/7-B, statement A). On good loam getting two waterings in September two in October, and one in November, there is much less difference between selected Desi and selected American types (*cf.* Square plot No. 46/18-E, 1-10, 46/18-E, 11-20, statement A).

All this is greatly in accordance with our experience in previous years (*cf.* paragraph 4 of Economic Botanist, Punjab's report for the year ending June 1914. Paragraph 3 of his report for 1916, paragraph 21 of his evidence to Indian Cotton Committee in 1918, Part II of his annual report for the year ending June 1919, etc.). Whether our selected Desi cotton will give better results than our American productions on good lands with fair cultivation and water-supply over a series of years remains to be seen.

Some of the better yields of Indian types grown on Botanical area were as follows:—

Name and number of cotton.	Area.	Dates of waterings after 1st September.	Kind of soil.	Outturn per acre.
				Mds. s. c.
G. I. Mollisoni 30 ...	1/12	10th September 1919, 4th October 1919, 29th October 1919, 7th November 1919, and 5th December 1919.	Fair loam ...	22 28 0
G. Sanguineum var minor 17 ...	1/8	1st September 1919, 15th September 1919, and 9th October 1919.	Rather sandy loam...	18 23 0
Ditto ...	1/8	Ditto ditto	Fair soil ...	13 15 0
Ditto 124 ...	1/4	10th September 1919, 4th October 1919, 29th October 1919, 7th November 1919, and 5th December 1919.	Fair loam ...	18 32 0
G. Neglectum 109 ...	1/4	Ditto ditto	Fair sandy loam ...	16 8 6
G. Neg. Roseum 124 ...	1/8	6th September 1919, 16th October 1919, and 19th November 1919.	Ditto ...	16 8 4
G. Indicum var Mollisoni 22 ...	1/4	10th September 1919, 4th October 1919, 29th October 1919, 7th November 1919, and 5th December 1919.	Ditto ...	16 8 0
		One maund = 82 lbs.		

Americans on the Botanical Area suffered much more than Indian cottons the better yields were as follows :—

Name and number of cotton.	Area in acres.	Dates of watering after 1st September.	Kind of soil.	Outturn per acre.
				Mds. s. c.
297-F. Acclimatised American ...	1/14	6th September 1919, 19th September 1919, 1st October 1919, 16th October 1919, and 2nd November 1919.	Good loam ...	11 28 0
298-F. ,, ,, ...	1/14	Ditto ditto	Do. ...	17 29 0
168-F. ,, ,, ...	1/7	10th September 1919, 19th September 1919, 4th October 19 9, 29th October 1919, 7th November 1919, and 5th December 1919.	Fair loam ...	10 6 0
285-F. ,, ,, ...	1/2	19th October 1919, 9th November 1919, and 5th December 1919. (More water not available.)	1/2 good loam ; 1/3 sandy loam ; remainder fair loam ; 1/3 of the whole manured 4 years ago.	6 10 0
275-II.-F. Punjab (Narma) ...	1/4	2 in September ... 2 in October.	Good heavy loam ...	10 16 0

Regarding cottons handed over to the Agricultural Farm I understand that our Indian selections have done far better than our Americans and that Mollisoni No. 24 has done best of all. G. Sanguineum No. 28 is also said to have done well, indeed.

A comparison of the results got from our Indian selections with what farmers got from ordinary Indian mixtures would do much to dispel the misconception that nothing has been done on Desi cottons.

285-F. and 4-F. Americans were grown side by side on 28 plots about 1/4 acre area each. The average outturn of the 14 plots of 285-F. was 5 maunds 5 seers and 6 chhataks and that of the 14 plots of 4-F. was 4 maunds, 5 seers and 6 chhataks. Half the number of plots of each type got two waterings in September, 2 in October, and 2 in November ; while the others got 1 watering in September, 1 in October, and 1 in November. In both the cases the average yield of 285-F. is better than 4-F., especially in the case of lighter waterings, where the difference was 1 maund 21 seers per acre in favour of 285-F. Our results in this and past years all indicate that 285-F. is a heavier cropper and more drought resistant despite its longer and finer lint. These yields are both very small, but a farmer in Chak No. 114 S. B., Lower Jhelum Canal, growing 285-F. on one acre of fair land in ordinary conditions got 12 maunds and 10 seers from 285-F. while his 4-F. growing around it gave far less outturn. Another farmer of Chak No. 232 R. B., Lower Chenab Canal, states that he got 12 maunds per acre from 285-F. and 6 maunds per acre from 4-F. These men sold the cotton of 285-F. to us.

Messrs. Ralli Brothers bought a consignment of 10 bales of 285-F. lint from us at Rs. 57 per maund, while 4-F. was selling at Rs. 44 per maund. Before buying this cotton they sent a sample to their Liverpool office for valuation.

Their report is as follows :—

> " The cotton in question has not got the general appearance of genuine American, but its staple compares very well with it and it is very fine and strong. It is classified as equal to about fully middling Memphis good 1·1/16 inches staple which was selling on 21st April on the spot at 2½*d.* above the corresponding futures.
>
> " On the basis of East Indian cotton the sample in question cannot be compared with the other American cotton grown in the Punjab as it is much superior in staple. From all the above it is clear that the cotton in question, provided it is kept well up in staple, will find ready buyers at substantially higher price, than those offered for ordinary Punjab American. In our opinion, therefore, cultivation of similar seed should be encouraged. "

Two bales of 285-F. and one bale of 4-F. were sent to the British Cotton-growing Association last year. The valuations came too late for last year's annual report. They were :—

A. (4-F.)—Very useful cotton with hard staple—valued at 17·75*d.*

B. (285-F.)—(grown by a farmer) good hard silky cotton—value about 19·75*d.*

C. (285-F.)—(grown in the Botanical Area) about equal to fully good middling American; about full 1·⅛" staple very useful cotton—Value 23·25*d*.

Value of Tinnevelly at this date 18·35*d*.

Value of fully middling futures 18·75*d*.

"That both B and C could be used in Lancashire; preference being given to C if it could be produced in large quantities." "That you will continue the good work you are doing with the new types 'B' and 'C' so that it may be possible for India to produce cotton similar to that which is extensively used in this country."

Twenty-one samples of American selections and 12 samples of Desi cottons were sent to Messrs. R. D. Tata & Co., Bombay, for valuation. Fine Scind American and fine Cambodia were selling at Rs 540 and Rs. 620 per candy (784 lbs.), respectively, when they were taken as the bases for valuation. 285-F. is valued at Rs. 700. "It is good for 50*s*. The cotton is curly though the staple is very long and strong. It resembles middling." 289-F. is valued at Rs. 680. "Its staple is long and silky. It is good for 50*s*."

Other selections 168-F., 281-F., 287-F. and cross A-15 are valued from Rs. 625 to Rs. 650.

4-F. comes very low. It is valued at Rs. 520 and is good for 20*s*. Its staple is fairly long and fibres are weak.

All these American selections have been reported on better than 4-F. (for valuation of Desi cotton see page 6). This year one bale of 285-F. and one of 4-F. have been sent to the British Cotton-growing Association for valuation.

Finally the year's work convinces me more than ever that the evolution of improved crops and their testing is the work of a specialist, and I have to see staff soon to deal with cottons as experience has shown it should be dealt with. If handled rightly much can be done to improve the crop of the Province otherwise the result can bring no credit to the Agricultural Department. None of our improvements have come accidentally.

VALUATION REPORT OF THE BRITISH COTTON-GROWING ASSOCIATION, MANCHESTER.

Report No. 1, dated September 4th.

Classification and Value.

Mark "A" (4-F).—413 lbs. Very useful cotton with hard staple, but spoilt by bad ginning and contains too much dirt and seed.

Nominal value about ½ off Fully Good Fair Tinnevelly; say, about 17·75*d*.

Mark "B" (285-F grown by a Farmers).—218 lbs. Good hard silky cotton, but contains a good deal of crushed seed and is rather dull and leafy.

Nominal value about 100 on September. Futures say 19·75*d*.

Mark "C" grown in the Botanical section.—156 lbs. About equal to Fully Good Middling American; about full 1·1/8" staple; very useful cotton.

Nominal value about 450 on September Futures, say, 23·25d.

Value of Tinnevelly at this date 18·35*d*.

Value of Fully Middling Futures 18·75*d*.

Report No. 2, dated September 12th 1919.

Classification and Value.

Mark "A." Indian character, rather leafy, staple about 7/8"; say, 16*d* quite nominal.

Mark "B."—About Fully Middling in grade; little stain; staple barely 1·3-16"; strong and silky; say, 20·50*d*.

Mark "C."—About Strict Good Middling in grade; staple about 1·3-16" and strong, say, 22·75*d*.

Value of Tinnevelly at this date 17·55*d*.

Value of Fully Middling Futures 18·25*d*.

You will notice that there is rather a big difference in our expert's views on sample "A;" this is owing to there not being much demand for this class of cotton and the price is therefore purely nominal.

In reference to sample "B" there is also a difference in price.

As regards sample "C" both valuations are practically identical.

In regard to their suitability for Lancashire, there is no doubt that "B" and "C" are both cottons which could be used in Lancashire, preference being given to "C" if it could be produced in large quantities.

I trust that you will continue the good work you are doing with the types "B" and "C," so that it may be possible for India to produce cotton similar to that which is extensively used in this country.

Valuation and report by Messrs. R. D. Tata and Co., Bombay, dated 16th July 1920, upon 33 samples of cotton submitted by this Economic Botanist to Government, Punjab:—

Basis.

					Rs.
Fine Scind America	...	...	...	...	540
Fine Surat	...	...	...	...	540
Fine Navasari	...	...	...	...	580
Fine Broach (crop spoiled, nominally quoted)			...	...	470
Fine Cambodia	...	...	...	...	620
Middling Spot in Liverpool			...	...	24*d.* per lb.
					Rs.
Final Bengal	...	...	...	...	250
Fine Berar	...	...	...	...	290
Fine Central Provinces	...	...	...	...	380

Serial No. 1. 4-F.—This resembles ordinary Scind America cotton, the staple is fairly long and fibres are weak. We value it at Rs. 520. It is good for 20*s*.

Serial No. 2, 161-F.—This cotton is long and silky, and it is superior to No. 1. We value it at Rs. 560. It is good for 30*s*.

Serial No. 3, 168-F.—This is superior to No. 2, having long and strong fibres. We value it at Rs. 625. It is good for 40*s*.

Serial No. 4, 271-F.—This resembles No. 1 in length, but the fibre is strong. We value it at Rs. 540 and it is good for 22*s*.

Serial No. 5, 275-I.—This sample is a bit inferior to No. 4, and resembles No. 1. We value it at Rs. 520. It is good for 20*s*.

Serial No. 6, 275-II-F.—This is better than Surat. It may be valued at Rs. 550. It is good for 26*s*.

Serial No. 7, 276-F.—This resembles Navasari cotton. We value it at Rs. 580. It is good for 32*s*.

Serial No. 8, 280-F.—This is almost equal to No. 2. We value it at Rs. 560. It is good for 30*s*.

Serial No. 9, 281-F.—This cotton resembles No. 3. We value it at Rs. 625. It is good for 40*s*.

Serial No. 10, 285-F.—This is superior to above all the nine samples examined by us. The cotton curly, though the staple is very long and strong. It resembles Middling. We value it Rs. 700. It is good for 50*s*.

Serial No. 11, 286-F.—This resembles Nos. 3 and 9. We value it at Rs. 625. It is good for 40*s*.

Serial No. 12, 286-F.—This cotton is better Navasari cotton. We value it at Rs. 600. It is good for 34*s*.

Serial No. 13, 287-F.—This is better than Nos. 3 and 4. We value it at Rs. 650. It is good for 40*s*.

Serial No. 14, 288-F.—This cotton is little inferior to Navasari. We value it at Rs. 560. It is good for 30*s*.

Serial No. 15, 289-F.—This cotton resembles No. 10 though not curly like it, long in staple and silky. It is good in appearance. We value it at Rs. 680 and it is good for 50*s*.

Serial No. 16, 292-F.—This sample resembles to sample No. 8. We value it at Rs. 560 and it is good for 30*s*.

Serial No. 17, 296-F.—This sample is almost equal to the above one in all respects.

Serial No. 18, 297-F.—This sample resembles Navasari cotton and we value it at Rs. 580. It is good for 32*s*.

Serial No. 19, 298-F.—This cotton is little bit inferior to the above one. We value it at Rs. 570. It is good for 32*s*.

Serial No. 20, Cross A 1-5.—This cotton resembles No. 10. It has improved by crossing though the fibres are rather weak. We value it at Rs. 650. It is good for 40s.

Serial No. 21, 199-F.—This cotton is very variable and we value it at Rs. 560. It is good for 30*s*.

Indian Cottons.

Serial Nos. 22 to 24.—We have examined those three samples and find them almost alike. The cotton is bulky and soft in feel, but have a very short staple All these three are superior to Bengal cotton but inferior to Berar. No. 22 (G. Indicum No. 26) is a little better than Nos. 23 and 24, No. 22 may be valued at Rs. 300. Nos. 23 and 24 may be valued at Rs. 290. All these three are good for 10*s*.

Serial Nos. 25 to 27.—The three samples resemble Bengal variety both in feel, appearance, and in length of staple. They are almost all alike and may be valued at Rs. 250. All are good for 8*s*.

Serial Nos. 28 and 29.—These two samples are superior to Nos. 22, 23 and 24. The cotton resembles Central Provinces' cotton, *viz.*—Wardha-Hinganghat. We value them at Rs. 380. They are good for 16*s*.

Serial Nos. 30 and 31.—Both the samples are rough in feel and short in staple. They resemble pure Bengal cotton and we value them at Rs. 240. They are good for 6*s*.

Serial Nos. 32 and 33.—Of these two samples No. 32 is superior to No. 33. No. 33 resembles Bengal cotton and may be valued at Rs. 250, it is good for 8*s*. No. 32 may be valued at Rs. 270 and is good for 10*s*.

Cotton Survey.—Cotton survey of the Rohtak District was carried out last year and the report will be submitted shortly.

Wheats.—The area under wheats this year was a little over 19 acres. Half of the land was medium loam and the rest sandy loam.

General.—355 different sowings were tested. The experimental plots in square 46 were 1/32 acre each and those in the new square No. 31 were 1/8 acre each. The wheats under trial in square No. 46 were interstripped with Punjab No. 9 as standard and the crosses grown there were tested against cross No. 3. The standard in each case was placed at an interval of about 40 feet to check the quality of land. In square No. 31 Punjab 11 was the standard. The previous crop was cotton in this area.

Cultivation and Irrigation.—Before sowing the land received the following treatment :—

Ploughing with Rajah plough	2
„ „ Desi „	3
Cultivation with spring toothed harrow	2

The land was irrigated once and ploughed twice with country plough to prepare the wheat seed bed.

As usual three irrigations were given to the crop after sowing but a fourth irrigation had to be given in certain cases where the land was sandy.

Season.—The season was quite favourable for the wheat crop. The total rainfall from June to May was 11·84 inches as given below :—

Months.	*Rainfall in inches.*
June	Nil
July	3·06
August	5·01
September	0·31
October	Nil.
November	Nil.
December	1·25
January	0·66
February	0·21
March	0·49
April	0·05
May	0·80

Twenty-five classified types of the Punjab wheats.—These wheats were grown in order to keep a stock of fresh seeds for demonstration and crossing purposes.

New types of the Punjab wheats.—As in the past years new types of wheats collected during the district wheat surveys were grown on plots of 1/32 acre each interstripped with Punjab No. 9 as standard.

Of these types 18-A, 20-A, 19-H, 25-C, 25-B, and 19-C have given the best results and are in the above order regarding their cropping powers. For the comparative outturns of the remaining types see Statement B.

Crosses.—122 selected crosses were tested on 1/32 acre plots against cross No. 3. Cross No. 3 has been selected as a standard because it stands well and gives good yields. Its highest outturn on good rich land has been 43 maunds 8 seers this year in plot No. 22 square No. 46. The land on which these crosses were grown is not of uniform texture as is evidenced by the unequal yields of the standard at various places. The outturn of the crosses is also similarly affected and their true position can be gauged from the number of marks abtained by them. Some of the crosses which have given good results are mentioned in the following statement :—

Cross No.	*Marks obtained.*
20	113
14	111
30	110
57	108
27	106
75	105
28	105
81	104
48	103
80	103
29	102
72	102
82	102
25	101
69	100

In the light of information gained from the milling and baking tests carried out in August-September 1918 some of the best wheats were crossed to evolve types of wheats which would suit zamindars, millers, and bakers better. These crosses are over 50 in number and are now in the second generation.

Testing of selected wheats and Pusa 12.—8-A, 8-B, 9-C, 16-A and 17-B new types of the Punjab wheats, crosses numbers 2 and 3 and Pusa 12 were tested against Punjab 11 in four sets on 1/8 acre plots each in the new area. Total area of this block of land which was divided into 4 plots Nos. 9, 10, 11 and 12, of 3 acres each is 8 acres in all.

About one and-a-half acres of land under Punjab 11, 9-C, Punjab 11, cross No. 2, Punjab 11, and cross No. 3 in plots Nos. 9 and 12 is very rich.

Statements C, D, E and F show their comparative yields of grain and bhusa.

In statement G the actual yields of each type tried in two opposite plots Nos. 10 and 11 are added together, respectively, and the average outturn of each type per acre is given.

Statement H serves the same purpose for plots Nos. 9 and 12.

Statement I indicates the average outturn per acre of each type tested in 4 sets.

The results of the varietal tests of our selected wheats, including Pusa 12 this year, and in the past years show that Pusa 12 and 8-B are early wheats, but they yield less than 8-A and Punjab 11. 8-B having strong straw and amber hard grain is being used for crossing.

9-C has done slightly better than Punjab 11.

16-A was grown for the first time in the new area. It has done fairly well.

Crosses Nos. 2 and 3 are bearded wheats and have amber-coloured hard grains. They have strong straw.

In plot No. 9 cross No. 3 yielded 38 maunds and 18 seers on trenched land, while Punjab 11 near it gave 30 maunds and 20 seers, *i.e.*, 2 maunds and 38 seers less then cross No. 3. In plots Nos. 10 and 11 cross No. 3 yielded an average of 27 maunds and 14 seers against Punjab 11 which gave 28 maunds and 37 seers, *i.e.*, 1 maund and 23 seers more than cross No. 3. In plot No. 12 one-third crop of cross No. 3 had nearly dried up for want of water and the rest had badly suffered. From the above results it is clear that cross No. 3 did better than Punjab 11 specially on rich land.

Cross No. 2 and 17-B have not done better than Punjab 11.

In 3 plots 8-A has yielded better than Punjab 11 and in one plot Punjab 11 has given more outturn than 8-A.

On the whole 8-A yielded an average of 32 maunds and 18 seers against Punjab 11 which has given on an average 30 maunds and 31 seers. (See statement I).

It has thus again maintained its position of superiority over other selected wheats tried in the Botanical Section and outside in the Punjab.

It was tested by the Deputy Director of Agriculture, Hansi, fourth time this year in duplicate sets against Punjab 14 the predominating wheat of the circle and the results received from him show that it has yielded an average of 30 maunds 12 seers 8 chataks per acre while Punjab 14 has given 27 maunds 31 seers 4 chataks, *i.e.*, 2 maunds 31 seers 4 chataks more in favour of 8-A. Punjab 11 which was tested similarly with Punjab 14 has given 2 maunds 6 seers and 4 chataks more than Punjab 14 per acre. 8-A therefore has indirectly done better than Punjab 11 by 25 seers.

At Gurdaspur farm varietal tests of our wheats and of some selected Pusa wheats were made on an extensive scale this year. From the results got it is clear that 8-A has done better than other types under trial there both on chahi and barani lands.

8-A has been grown on the Sargodha Seeds Farm for the last three years and has again proved the best yielder this time. It is very much liked by the zamindars, and I am told that about 3,000 maunds of it have been stored by the Deputy Director of Agriculture, Gurdaspur, for distribution next year.

8-A was tested in Hoshiarpur District against Pusa 12 and local wheats on zamindari lands and it has turned out to be the best. Growers are extremely pleased with it. Arrangements have been made for giving it to the zamindars next season.

The Agricultural Assistant in charge of the district work, Sialkot, reports that 8-A has done exceedingly well and it is found better than Pusa 12.

The Professor of Agriculture carried out the varietal tests of 8-A and Punjab 11 again this year on the Lyallpur Farm. In square No. 32 on 6 acres 8-A has beaten Punjab 11 by 18½ seers in later sowings with 2 and 3 irrigations.

It has not done so well as Punjab 11 in early sowings. But as there are so many factors which can be responsible for the differences in outturns of these wheats I would not attempt dealing with the matter in this report. 8-A has done invariably better than all wheats, including Punjab 11 and Pusa 12 under trials at Sargodha.

In square No. 26 Punjab 11 has yielded 1 maund 11 seers more than 8-A this year. But in the previous years 8-A has been giving constantly higher outturn than Punjab 11, *vide* statement given below. The results obtained in this square from this year's test cannot therefore be considered comparable.

Statement of comparative outturns of varietal tests of 8-A and Punjab 11 made by the Professor of Agriculture on square Nos. 26, 32 and tenants area.

Type No.	1916-17.		1917-18.			1918-19*			1919-20.		
	Sq. 26.	Tenant area.	Sq. 26.	43 Sq.	Tenant area.	26 Sq.	43 Sq.	Tenant area.	26 Sq.	32 Sq.	Tenant area.
	Md. s.	Md. s.	Md. s.	Md. s.	Md. s.	Md. s.	Md. s.	Md. s.	Md. s.	Md. s.	Md. s.
8-A ...	23 38	15 23	20 0	15 33	12 29	22 35	24 14	19 17	27 24	27 11	25 18
P.-11 ...	23 0	14 38	19 6	11 22	12 26	22 8	25 37	20 20	28 35	27 23	25 29

(*) 8-A was 20 per cent. damaged by white ants.

In the tenants area Punjab 11 has no doubt shown an increase of 11 seers over 8-A on an area of about 28 acres. But considering that 8-A was badly attacked by white ants in some of the plots this difference becomes immaterial. 8-A is preferred by the zamindars to Punjab 11 because it has hard amber coloured grain and is much better for making country bread. In the last milling and baking tests also it has proved superior to Punjab 11.

The milling and baking tests of our selected wheats were carried out again this year. In this connection I may state that our work has been aimed at giving us a comparison of the economic values of our different types of wheat, but our investigations into some of the factors involved, *i.e.* (baking outturns) have not gone far enough to enable us to calculate the complete comparative economic values with confidence, therefore the complete calculations are not yet made. The Director and Manager of the Pioneer Flour Mills, Shahdara, had given us the facilities at their command to have our wheat types milled to show their relative milling qualities, but we found that it was not possible to get accurate data on all points and this is likely to be the case in future trials in a commercial mill. Accurate data is absolutely essen.

tial before we can work out the comparative economic values of our types and be able to recommend the best of them to be grown or continue to cross the varieties we have.

Wheat survey.—Wheat survey of the Multan District was carried out last year and the report will be submitted shortly.

Barleys.—Twenty-four varieties of Punjab barleys were grown on the Botanical Area on plots 1/ 2 acre each with the local type as standard. Out of these types Nos. 1, 4 and 5 are very promising and have given an average outturn of over 40 maunds per acre this year. These types were also tried by the Deputy Director of Agriculture, Hansi, in his circle, No. 5 grown on the Hansi Farm had given the best yield of 31 maunds 32 seers per acre. While the average outturn of the local type was 23 maunds 30 seers. No. 4 has given 30 maunds 9 seers. In the tests made by the Deputy Director of Agriculture, Hansi, in the Rewari Tahsil at 3 different places, No 4 appears to have done the best.

No. 5 has uniform and large sized grain, but is somewhat late in ripening. No. 4 is arlier. They have been crossed to combine the desired characters.

Grams.—Twenty-six distinct types isolated in the previous years were grown in the Botanical Area. Of these Nos. 7, 12, 14, 15, 17, 18, 20 and 24 have given the highest yields.

Nos 7, 15, 17, and 20 were tried on the Agricultural Farm at Lyallpur, Gurdaspur, Sargodha, and Hansi. The tests carried out on the Lyallpur Agricultural Farm have been extensive. Each variety was grown against the local type in 4 sets and has done better than the local grams.

Gram Wilt.—Gram plants have usually been found to be attacked by a wilt disease in the colony and elsewhere. The disease generally shows itself about the flowering period and results in the complete withering of the affected plants. Small black spots are noticeable on the branches. It has been noticed that the disease is much less if rain falls or the fields are watered a little before the appearance of the flowers. The plants situated on high patches in the fields are more liable to be affected while those growing along the water-courses have invariably been free from the disease. This shows that want of water in one of the factors in the incidence of the disease. To confirm the results of these observations and to investigate into other causes of the disease some experiments have been started in the Botanical Area. The results so far obtained indicate that grams give the best results with one watering and that it should be given a few days before the flowering time.

Further we have observed in our experimental plots that the disease was the worst in the fields which did not receive any artificial watering.

The experimets are being continued.

Potatoes.—Experiments with Scotch potatoes were continued in Simla Hills. They yielded better than the Desi potatoes, and the farmers who had grown Scotch varieties made a profit of over Rs. 150 more than what they got from the Desi crop. There is considerable demand throughout the Province for our improved varieties.

Six varieties of Scotch potatoes—Nos. 3, 6, 11, 17, 18, and 19—were grown interstripped with the local variety in different fields over 3½ acres at the following places :—

(1) Pajog, (2) Kufri, (3) Phagu.

(Detailed report was submitted to the Director of Agriculture with my letter No. 5256—43-4, dated 8th November 1919.)

All the varieties yielded more than the Desi potatoes, Nos. 3, 17 and 18 did the best.

The year under report was unfavourable for the potato crop on account of heavy rains accompanied by hail-storms which came off and on from July up to the time of harvest.

Rain fell mostly during the period when potato tubers were developing and ripening and the crop suffered much in clayey soils which did not in some cases give an outturn even equal to the amount of seed.

In shaley lands the crop was better but below normal. A statement showing the average outturn of Scotch and Desi potatoes on clayey and shaley lands as well as the comparative profit per acre got by growing them alongside each other is given in the statement J. attached.

Varieties Nos. 3, 17, and 18 were grown at Sialkot alongside the local variety "Gola."

No. 3 gave the best outturns of 139 maunds and 26 seers, while Gola yielded an average of 119 maunds.

There is a great demand for seed potatoes of No. 3 and arrangements are being made to multiply it for supplying it to the zamindars.

Date-palms.—The fruits borne by the Arabian date trees in the Muzaffargarh, Multan, and Leiah plantations are being cured and we expect fine dates this year. Season during the

greater part of the ripening period has been favourable. Light showers that fell in the end of July did a little damage however.

An Assistant has been sent to Basra to purchase 6,000 suckers. Applications for about 4,000 suckers have already been received from zamindars and more are coming in.

About 2 acres of the Date Farm at Muzaffargarh were planted with Date trees and suckers removed from Multan Jail and Taleri *bagh* plantations. We hope to plant about ten acres more of this with suckers expected from Basra.

Drugs.—A scheme for work on drugs in the Punjab was drawn up and sent to the Secretary, Drugs Manufacture Committee, for his opinion. The scheme has been approved, but a specially qualified staff will be required to carry on the work.

Samples of Hyoscyamus muticus and H. Niger grown in the Botanical Area have been sent to the Secretary for examination and report.

Root Rot.—Experiments to find out the cause of the root rot disease in cotton were continued.

Earcockle.—Experiments at Lyallpur indicate that Tylenchus kept stored from harvest till next sowing time (7 months) are 20 to 30 times more virulent than those kept for one and-a-half years and those kept for more years only lose their vitality comparatively slowly after the first season. Infections to soil have produced galls on barley heads, but we have not found galls on oats, etc., so far.

In the wheat survey of Multan District this year quite a number of cases of 10 per cent. destruction by Earcockle were seen, a few cases up to 40 or 50 per cent.

In Lyallpur District a case of about 25 per cent., and in the Shahpur District one of about 30 per cent. damage were seen.

The disease obviously does extensive damage and is often ruinous where it does occur. Fortunately any field can be rid of it in a single year. The Registrar, Co-operative Societies, has sent some assistants for training regarding it.

Red-Rot.

(Colletotrichum falcatum on sugarcane.)

At Ferozepore where much damage is done by Red Rot to thick sugarcane experiments with—

(*a*) sets reddened by the disease ;

(*b*) unreddened sets from diseased plots ; and

(*c*) tops of slightly affected canes, were grown interstripped with healthy sets. The crop from (*a*) apparently lost 67 per cent. by this disease ; that from (*b*) 57 per cent., and that from (*c*) 37 per cent. Zamindars were very interested.

An illustrated leaflet in Urdu and Gurmukhi dealing with the causes of red-rot in sugarcane and its remedial and preventive measures has been published and is being distributed among the sugarcane growers in the Ferozepore, Gurdaspur, and other districts.

Lathyrism.—Some experiments were conducted on rabbits, etc., to find out the effects of feeding animals on seeds of Lathyrus sativus. Report on the work done has been submitted to the Government and is being printed.

Miscellaneous.—The post of an artist for Botanical Section was sanctioned, and M. Muhammad Hussain who had worked under Mr. Grove, formerly Supernumerary Entomologist, has been appointed to it. He is preparing coloured illustrations of the Punjab cottons, which will be incorporated in a memoir on the subject.

In connection with the extension to the College building proposals and plans for erecting a separate block of Junior Botanical laboratory, Physiological laboratory, lecture room, museum, etc., were prepared and submitted to the Director of Agriculture. Progress and development of the Botanical Garden and teaching collection area has been considerably hampered for want of adequate and timely supply of water. This difficulty will, however, soon be overcome by the tube-well which is under construction and is expected to be completed within the next year. In the end I have great pleasure in acknowledging the good work done by the whole of my staff.

JAI CHAND LUTHRA,

Economic Botanist to Government, Punjab, Lyallpur.

STATEMENT A.

Square and plot No., &c.	Name and number of cotton variety.	Area in acres.	Date of Sowing.	Date of Waterings given after 1st September.	Outturn of Kapas. Actual. Maunds.	Actual. Seers.	Actual. Chataks.	Per acre. Maunds.	Per acre. Seers.	Per acre. Chataks.
46 / 18-E. / 1—10	American cotton selection ...	1/14	25th April 1919 ...	6th September 1919, 19th September 1919, 1st October 1919, 16th October 1919, and 2nd November 1919.	1	5	10	15	13	0
46 / 18-E. / 11—20	Desi selected Mollisoni ...	1/14	Ditto ...	Ditto	1	7	4	16	8	0
31 / 5-B.	American selection 285-F. (*a*) ...	1/2	Ditto ...	19th October 1919, 9th November 1919, and 5th December 1919.	3	4	15	6	10	0
31 / 5-B.	Unmanure portion of plot 31/5-B. 285-F. ...	...	...	Ditto	Included in (*a*)					
31 / 5-A.	Desi 132 Roseum (*a*) ...	1/2	25th April 1919 ...	Ditto	6	24	4	13	8	8
	Ditto (*b*) ...	...	...	...	Included in (*a*)					
28 / 17-A. / 1—20	American selection 168-F. ...	1/7	19th April 1919 ...	10th September 1919, 19th September 1919, 4th October 1919, 29th October 1919, 7th November 1919, and 5th December 1919.	1	18	2	10	6	0
28 / 17-A. / 21—40	Desi selected N. L. R. F. sanguineum	1/7	Ditto ...	10th September 1919, 4th October 1919, 29th October 1919, 7th November 1919, and 5th December 1919.	1	12	14	9	11	0
28 / 17-B. / 21—40	American 161-F. ...	1/7	Ditto ...	Ditto	0	32	0	5	24	0
31 / 6-C.	American 288-F. ...	1/2	24th April 1919 ...	6th September 1919, 16th October 1919, 19th November 1919, and 10th December 1919.	0	39	4	2	0	0
31 / 6-B.	Desi 124 Roseum ...	1/2	Ditto ...	6th September 1919, 16th October 1919, and 19th November 1919.	7	16	14	14	34	0
31 / 6-A.	American 285-F. ...	1/2	Ditto ...	Ditto	2	10	12	4	22	0
31 / 7-A.	American 285-F. ...	1/2	16th April 1919 ...	1st September 1919, 15th September 1919, and 9th October 1919.	1	19	13	3	0	0
31 / 7-B.	Desi 132 Roseum ...	1/2	Ditto ...	Ditto	6	13	0	12	26	0
28 / 17-A. / 41—60	American 126-F. ...	1/7	19th April 1919 ...	4th September 1919, 4th October 1919, 29th October 1919, 7th November 1919, and 5th December 1919.	0	13	4	2	1	0

ment A.

Kind and quality of soil.	Per cent. stand of the crop.	Shedding of flowers, flower buds, etc., from 1st to 25th September.	Opening of bolls (good, bad, poor).	Quality of fibre.	Cultivation. Before sowing.	Cultivation. After sowing.	Remarks.
Good loam unmanured	100	Little ...	Good ...	Good ...	Raja ploughing ... 1 Desi ploughing ... 6 Harrowing ... 1	Hoeing with horse hoe 4.	
Ditto ...	100	Do. ...	Do. ...	Do. ...	Ditto	Ditto.	
(*a*) Good loam heavily manured 4 years ago.	84	Heavy ...	Fai to poor ...	Fair to poor ...	Raja ploughing ... 1 Desi ploughing ... 4 Harrowing ... 1	Ditto ...	This plot has got about ¼th of its land very sandy which is dealt with under (*b*).
(*b*) Sandy unmanured	...	Bad ...	Do. ...	Do. ...	Ditto	Ditto.	
Good loam like (*a*) in $\frac{31}{5\text{-B.}}$	90	Medium ...	Good ...	Good ...	Ditto	Ditto.	
Sandy loam like $\frac{31}{5\text{-B.}}$ (*b*)	...	Do. ...	Do. ...	Do. ...	Ditto	Ditto ...	Re-sown on 25th May 1919.
Fair loam unmanured...	98	Little ...	Fair to good ...	Do. ...	Raja ploughing ... 1 Desi ploughing ... 6 Harrowing ... 1	Hoeing with horse hoe 5.	
Fair loam unmanured ¼ compact.	95	Bad in compact portion, but little on fair portion.	Good ...	Do. ...	Ditto	Ditto.	
Loam unmanured rather of harder texture.	100	Bad ...	Poor ...	Poor ...	Ditto	Ditto.	
Sandy ...	60	Very bad ...	Bad ...	Do. ...	Raja ploughing ... 1 Desi ploughing ... 3 Harrowing ... 1	Hoeing with horse hoe 4.	
Do. ...	94	Medium ...	Very fair ...	Good ...	Ditto	Ditto.	
Do. ...	60	Heavy ...	Opening fair alongside of water channel, rest poor.	Fair to poor ...	Ditto	Ditto.	
Do. ...	75	Heavy in October, little in September.	Ditto	Poor ..	Raja ploughing ... 1 Desi ploughing ... 3 Harrowing ... 2	Hoeing with horse hoe 3.	Re-sown on 19th April 1919.
Do. ...	92	Little ...	Good ...	Good ...	Ditto	Ditto	Ditto.
Compact ...	94	Heavy ...	Poor ...	Poor ...	Raja ploughing ... 1 Desi ploughing ... 6 Harrowing ... 1	Hoeing with horse hoe 5.	This soil does not retain moisture well and also does not absorb irrigation water as rapidly as other soils do.

Statement B.

NEW TYPES OF THE PUNJAB WHEATS.

Type No.	Plot and square No.	Area in acre.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chhataks.	Straw. Maunds	Straw. Seers.	Straw. Chhataks.	Outturn equivalent to 100 marks. Maunds.	Seers.	Chhataks.	Marks obtained by each type.	Remarks.
Punjab 9 (Standard) ...	20	1	19th November 1919 ...	11th March 1920 ...	28th April 1920 ...	29	8	0	126	0	0	29	8	0	100	Whole crop lodged on 13th March 1920.
	46	32														
8-B			Ditto ...	7th March 1920 ...	20th April 1920 ...	36	0	0	116	32	0	37	24	0	95	Ditto ditto.
8-A			Ditto ...	12th March 1920 ...	30th April 1920 ...	37	24	0	114	16	0	37	24	0	100	Ditto ditto.
9-C			Ditto ...	9th March 1920 ...	20th April 1920 ...	32	32	0	83	8	0	37	24	0	87	Ditto ditto.
Punjab 9 (Standard) ...			Ditto ...	14th March 1920 ...	30th April 1920 ...	37	24	0	93	24	0	37	24	0	100	$\frac{1}{20}$th crop lodged on 13th March 1920.
16-A			Ditto ...	9th March 1920 ...	22nd April 1920 ...	35	8	0	91	8	0	36	38	4	95	$\frac{1}{4}$th crop lodged on 13th March 1920.
17-A			Ditto ...	Ditto ...	Ditto ...	42	0	0	78	0	0	36	12	11	115	$\frac{1}{8}$th crop lodged on 13th March 1920.
17-B			Ditto ...	10th March 1920 ...	Ditto ...	36	0	0	70	16	0	35	27	2	100	$\frac{1}{10}$th crop lodged on 13th March 1920.
17-C			Ditto ...	12th March 1920 ...	26th April 1920 ...	39	8	0	86	16	0	35	1	9	112	Ditto ditto.
Punjab 9 (Standard) ...			Ditto ...	14th March 1920 ...	30th April 1920 ...	34	16	0	93	24	0	34	16	0	100	$\frac{1}{12}$th crop lodged on 13th March 1920.
18-A			Ditto ...	12th March 1920 ...	26th April 1920 ...	43	24	0	84	16	0	33	11	0	131	Ditto ditto.
19-A			Ditto ...	11th March 1920 ...	24th April 1920 ...	30	8	0	67	16	0	32	6	0	94	$\frac{1}{21}$st crop lodged on 13th March 1920.
19-B			Ditto ...	12th March 1920 ...	Ditto ...	34	16	0	76	0	0	31	1	0	111	$\frac{1}{10}$th crop lodged on 13th March 1920.
19-C			Ditto ...	11th March 1920 ...	22nd April 1920 ...	36	24	0	89	32	0	29	36	0	122	$\frac{1}{4}$th crop lodged on 13th March 1920.
Punjab 9 (Standard) ...			Ditto ...	14th March 1920 ...	30th April 1920 ...	28	32	0	107	8	0	28	32	0	100	$\frac{1}{20}$th crop lodged on 13th March 1920.
19-D			Ditto ...	Ditto ...	Ditto ...	26	32	0	66	0	0	29	9	12	92	$\frac{1}{15}$th crop lodged on 13th March 1920.
19-E			Ditto ...	10th March 1920 ...	24th April 1920 ...	34	24	0	74	8	0	29	27	5	117	

19-F			Ditto ...	13th March 1920 ...	22nd April 1920 ...	33	24	0	76	0	0	30	4	14	112							
19-G			Ditto ...	14th March 1920 ...	26th April 1920 ...	30	32	0	87	24	0	30	22	7	101	$\frac{1}{20}$th crop lodged on 13th March 1920.						
Punjab 9 (Standard) ...			Ditto ...	Ditto ...	22nd April 1920 ...	31	0	0	80	8	0	31	0	0	100	Ditto	ditto.					
19-H	20	1	Ditto ...	12th March 1920 ...	Ditto ...	40	0	0	84	32	0	31	5	0	128							
19 I	46	32	Ditto ...	11th March 1920 ...	Ditto ...	36	32	0	85	24	0	31	10	0	118	$\frac{1}{20}$th crop lodged on 13th March 1920.						
19 J			Ditto ...	15th March 1920 ...	24th April 1920 ...	38	16	0	93	24	0	31	15	0	122							
19-K			Ditto ...	Ditto ...	22nd April 1920 ...	34	32	0	78	32	0	31	20	0	110							
Punjab 9 (Standard) ...			Ditto ...	14th March 1920 ...	30th April 1920 ...	31	24	0	90	0	0	31	24	0	100							
20-A			Ditto ...	11th March 1920 ...	24th April 1920 ...	43	8	0	81	24	0	32	13	0	134	$\frac{1}{12}$th crop lodged on 13th March 1920.						
20-B			Ditto ...	12th March 1920 ...	Ditto ...	36	32	0	83	8	0	33	1	0	111	$\frac{1}{20}$th crop lodged on 13th March 1920.						
20-C			Ditto ...	Ditto ...	26th April 1920 ...	32	0	0	64	32	0	33	30	0	95	Ditto	ditto.					
20-D			Ditto ...	10th March 1920 ...	22nd April 1920 ...	34	16	0	82	16	0	34	19	0	100	$\frac{1}{12}$th crop lodged on 13th March 1920.						
Punjab 9 (Standard) ...			Ditto ...	14th March 1920 ...	30th April 1920 ...	35	8	0	96	0	0	35	8	0	100	Ditto	ditto.					
20-E			Ditto ...	20th March 1920 ...	3rd May 1920 ...	29	24	0	90	16	0	35	21	0	83							
23-A			Ditto ...	14th March 1920 ...	24th April 1920 ...	37	32	0	75	32	0	35	34	0	106							
24-A			Ditto ...	10th March 1920 ...	22nd April 1920 ...	36	0	0	85	24	0	36	7	0	100	$\frac{1}{2}$ crop lodged on 13th March 1920.						
24-B			Ditto ...	11th March 1920 ...	Ditto ...	33	24	0	82	16	0	36	20	0	92	$\frac{3}{4}$th crop lodged on 13th March 1920.						
Punjab 9 (Standard) ...			Ditto ...	14th March 1920 ...	30th April 1920 ...	36	32	0	84	32	0	36	32	0	100							
24-C			Ditto ...	10th March 1920 ...	22nd April 1920 ...	28	32	0	53	24	0	35	28	0	81	$\frac{1}{3}$rd crop lodged on 13th March 1920.						
24-D			Ditto ...	12th March 1920 ...	Ditto ...	31	8	0	73	8	0	34	23	0	90	$\frac{1}{20}$th crop lodged on 13th March 1920.						
25-A			Ditto ...	14th March 1920 ...	26th April 1920 ...	38	16	0	83	8	0	33	18	0	115							
25-B			Ditto ...	13th March 1920 ...	Ditto ...	40	32	0	76	0	0	32	13	0	126							
Punjab 9 (Standard) ...			Ditto ...	14th March 1920 ...	Ditto ...	31	8	0	69	24	0	31	8	0	100							
25-C			Ditto ...	Ditto ...	Ditto ...	40	32	0	72	32	0	31	30	0	128							
9-A			Ditto ...	13th March 1920 ...	29th April 1920 ...	36	32	0	80	0	0	32	12	0	114	$\frac{1}{20}$th crop lodged on 13th March 1920.						
9-B			Ditto ...	15th March 1920 ...	28th April 1920 ...	35	32	0	87	16	0	32	34	0	109	$\frac{1}{10}$th crop lodged on 13th March 1920.						
8-C			Ditto ...	Ditto ...	29th April 1920 ...	29	24	0	76	0	0	33	16	0	89	Ditto	ditto					
Punjab 9 (Standard) ...			Ditto ...	14th March 1920 ...	30th April 1920 ...	34	0	0	85	8	0	34	0	0	100							
4-A			Ditto ...	15th March 1920 ...	Ditto ...	33	24	0	65	24	0	31	24	0	106							

Statement C.

SET No. 1.

Type No.	Plot and square No.	Area in acre.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chhataks.	Straw. Maunds.	Straw. Seers.	Straw. Chhataks.	Remarks.
Punjab 11 ...			17th November 1919.	9th March 1920	30th April 1920	26	0	0	51	0	0	
8-A ...			Ditto	11th March 1920	Ditto	32	6	0	51	2	0	
Punjab 11 ...			Ditto	9th March 1920	Ditto	30	30	0	61	34	0	
8-B ...			Ditto	4th March 1920	20th April 1920	26	24	0	52	0	0	
Punjab 11 ...			18th November 1919.	9th March 1920	29th April 1920	20	14	0	53	2	0	
Pusa 12 ...			Ditto	4th March 1920	20th April 1920	28	24	0	45	24	0	
Punjab 11 ...			Ditto	9th March 1920	29th April 1920	24	38	0	56	18	0	Thin stand of crop.
17-B ...	10	1	Ditto	Ditto	21st April 1920	26	12	0	44	16	0	
Punjab 11 ...	31	8	Ditto	Ditto	29th April 1920	27	24	0	52	18	0	
16-A ..			Ditto	8th March 1920	23rd April 1920	26	38	0	47	26	0	
Punjab 11 ..			Ditto	9th March 1920	29th April 1920	26	0	0	55	0	0	
9-C ...			Ditto	7th March 1920	23rd April 1920	28	24	0	49	8	0	
Punjab 11 ...			Ditto	9th March 1920	29th April 1920	26	8	0	49	32	0	
Cross 3			Ditto	10th March 1920	30th April 1920	28	16	0	51	24	0	Thin stand of crop.
Punjab 11 ...			Ditto	9th March 1920	28th April 1920	30	36	0	56	36	0	
Cross 2 ...			Ditto	Ditto	30th April 1920	28	38	0	54	2	0	

Statement D.

SET No. 2.

Type No.	Plot and square No.	Area in acre.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chhataks.	Straw. Maunds.	Straw. Seers.	Straw. Chhataks.	Remarks.
Punjab 11 ...			17th November 1919.	9th March 1920	30th April 1920	27	18	0	44	38	0	
8-A ...			Ditto	11th March 1920	Ditto	32	18	0	60	14	0	
Punjab 11 ...			Ditto	9th March 1920	Ditto	30	12	0	48	36	0	
8-B ...			Ditto	4th March 1920	20th April 1920	25	0	0	43	16	0	
Punjab 11 ...			Ditto	9th March 1920	29th April 1920	29	18	0	43	38	0	
Pusa 12 ...			Ditto	4th March 1920	20th April 1920	27	12	0	45	4	0	
Punjab 11 ...			Ditto	9th March 1920	29th April 1920	26	16	0	41	0	0	
17-B ...	11	1	Ditto	Ditto	21st April 1920	25	28	0	44	36	0	Germination rather thin in the whole plot.
Punjab 11 ...	31	8	18th November 1919.	Ditto	29th April 1920	27	4	0	49	4	0	
16-A ...			Ditto	8th March 1920	23rd April 1920	25	24	0	41	0	0	
Punjab 11 ...			Ditto	9th March 1920	28th April 1920	26	30	0	43	26	0	
9-C ...			Ditto	7th March 1920	23rd April 1920	26	8	0	47	16	0	
Punjab 11 ...			Ditto	9th March 1920	29th April 1920	29	30	0	48	38	0	
Cross 3 ...			Ditto	10th March 1920	30th April 1920	26	12	0	45	20	0	
Punjab 11 ...			Ditto	9th March 1920	28th April 1920	28	32	0	53	0	0	
Cross 2 ...			Ditto	Ditto	30th April 1920	30	8	0	61	0	0	

Statement E.

SET No. 3.

Type No.	Plot and square No.	Area in acre.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre, Grain. Maunds.	Grain. Seers.	Grain. Chhataks.	Straw. Maunds.	Straw. Seers.	Straw. Chhataks.	Remarks.
Punjab 11 ...			21st November 1919.	10th March 1920	30th April 1920	34	24	0	61	16	0	
8-A ...			Ditto	12th March 1920	Ditto	33	30	0	60	34	0	
Punjab 11 ...			Ditto	10th March 1920	28th April 1920	29	34	0	58	38	0	
8-B ...			Ditto	5th March 1920	21st April 1920	27	0	0	56	16	0	
Punjab 11 ...			Ditto	10th March 1920	28th April 1920	28	36	0	60	20	0	
Pusa 12 ...			Ditto	5th March 1920	20th April 1920	27	36	0	57	20	0	
Punjab 11 ...			Ditto	10th March 1920	28th April 1920	30	36	0	68	20	0	
17-B ...			Ditto	Ditto	21st April 1920	29	0	0	55	16	0	
Punjab 11 ...			22nd November 1919.	Ditto	28th April 1920	31	0	0	62	16	0	
16-A ...			Ditto	8th March 1920	21st April 1920	29	0	0	59	24	0	
Punjab 11 ...			Ditto	10th March 1920	28th April 1920	26	8	0	83	16	0	Trenched land. ½ crop lodged on 8th March 1920.
9 C ...	9 to 31	1 to 8	Ditto	8th March 1920	23rd April 1920	26	2	0	76	30	0	Trenched land. Whole crop fell flat on 8th March 1920.
Punjab 11 ...			Ditto	10th March 1920	29th April 1920	21	24	0	77	16	0	Trenched land. Suffered for want of water. ½ crop fell flat on 8th March 1920.
Cross 2 ...			Ditto	Ditto	30th April 1920	23	28	0	71	36	0	Ditto.
Punjab 11 ...			Ditto	Ditto	Ditto	30	20	0	104	36	0	Trenched land. Whole crop fell flat on 8th March 1920,
Cross 3 ...			Ditto	11th March 1920	Ditto	33	18	0	96	30	0	Trenched land. Whole crop bent down on 8th March 1920.

Statement F.

SET No. 4.

Type No.	Plot and square No.	Area in acre.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre, Grain. Maunds.	Grain. Seers.	Grain. Chhataks.	Straw. Maunds.	Straw. Seers.	Straw. Chhataks.	Remarks.
Punjab 11 ...			21st November 1919.	10th March 1920	30th April 1920	32	24	0	48	32	0	
8-A ...			Ditto	12th March 1920	Ditto	31	22	0	50	10	0	1/10th crop lodged on 8th March 1920. Land being higher crop suffered for want of water.
Punjab 11 ...			Ditto	10th March 1920	29th April 1920	34	28	0	57	28	0	
8-B ...			Ditto	5th March 1920	20th April 1920	28	24	0	59	32	0	
Punjab 11 ...			Ditto	10th March 1920	28th April 1920	33	2	0	63	30	0	
Pusa 12 ...			Ditto	5th March 1920	20th April 1920	31	34	0	58	30	0	
Punjab 11 ...			Ditto	10th March 1920	28th April 1920	34	2	0	67	6	0	
17-B ...			Ditto	Ditto	20th April 1920	30	0	0	59	32	0	
Punjab 11 ...			22nd November 1919.	Ditto	28th April 1920	30	24	0	70	0	0	
16-A ...			Ditto	8th March 1920	21st April 1920	31	8	0	71	16	0	
Punjab 11 ...	12 to 31	1 to 8	Ditto	10th March 1920	28th April 1920	28	36	0	92	28	0	Trenched land. ⅔rd crop lodged on 8th March 1920.
9-C ...			Ditto	8th March 1920	23rd April 1920	29	32	0	92	8	0	Trenched land. Whole crop lodged on 8th March 1920.
Punjab 11 ...			Ditto	10th March 1920	29th April 1920	30	6	0	93	26	0	Ditto.
Cross 2 ...			Ditto	Ditto	30th April 1920	28	14	0	62	34	0	Trenched land. ½ crop lodged on 8th March 1920.
Punjab 11 ...			Ditto	Ditto	29th April 1920	27	8	0	91	16	0	Trenched land. Whole crop lodged on 8th March 1920.
Cross 3 ...			Ditto	Ditto	30th April 1920	28	34	0	88	30	0	Trenched land. Suffered for want of water. ⅓rd crop had nearly dried up. ½ crop lodged on 8th March 1920.

Statement G.

SETS Nos. 1 & 2.

Type No.	Area in acre.	Plot and square No.	Outturn per acre. Grain. Maunds.	Grain. Seers	Grain. Chataks.	Straw. Maunds.	Straw. Seers.	Straw. Chataks.	Remarks.
Punjab 11	¼	10 & 11 / 31	26	29	0	47	39	0	
8-A			32	12	0	55	28	0	
Punjab 11			30	21	0	55	15	0	
8-B			25	32	0	47	28	0	
Punjab 11			29	16	0	48	20	0	Stand of crop thin in plot No. 10.
Pusa 12			27	38	0	45	14	0	
Punjab 11			25	27	0	48	29	0	
17-B			26	0	0	44	26	0	Germination rather thin in ¼ acre.
Punjab 11			27	14	0	52	6	0	
16-A			26	11	0	44	13	0	
Punjab 11			26	15	0	49	13	0	
9-C			27	16	0	48	12	0	
Punjab 11			27	39	0	49	15	0	
Cross 3			27	14	0	48	22	0	Stand of crop thin in plot No. 10.
Punjab 11			29	34	0	54	38	0	
Cross 2			29	23	0	57	21	0	

Statement H.

SETS Nos. 3 & 4.

Type No.	Area in acre.	Plot and square No.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chhataks.	Straw. Maunds.	Straw. Seers.	Straw. Chhataks.	Remarks.
Punjab 11	¼	9 & 12 / 31	33	24	0	55	4	0	
8-A			32	25	0	55	22	0	1/10th crop lodged on 8th March 1920 in plot No. 12.
Punjab 11			32	11	0	58	13	0	Land being higher suffered for want of water in plot No. 12.
8-B			27	32	0	58	4	0	
Punjab 11			30	39	0	62	5	0	
Pusa 12			29	35	0	55	5	0	
Punjab 11			32	19	0	67	33	0	
17-B			29	20	0	57	24	0	
Punjab 11			30	32	0	66	8	0	
16-A			30	4	0	65	20	0	
Punjab 11			27	22	0	88	2	0	
9-C			27	37	0	84	19	0	
Punjab 11			25	35	0	85	21	0	Whole crop in plot No. 9 suffered for want of water.
Cross 2			26	1	0	67	15	0	Ditto ditto.
Punjab 11			23	34	0	98	6	0	
Cross 3			28	26	0	92	30	0	⅓rd crop in plot No. 12 had nearly dried up for want of water and the rest had badly suffered.

Statement I.

SETS Nos. 1, 2, 3 & 4.

Type No.	Area in acre.	Plot and square No.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chhatak.	Straw. Maunds.	Straw. Seers.	Straw. Chhatak.	Remarks.
Punjab 11 ...			30	6	8	56	21	8	
8-A ...			32	18	8	55	25	0	
Punjab 11 ...			31	16	0	56	34	0	
8-B ...			26	32	0	52	36	0	
Punjab 11 ...			30	7	8	55	12	8	
Pusa 12 ...			28	36	8	50	9	8	
Punjab 11 ...			29	3	0	58	11	0	
17-B ...	½	9, 10, 11, 12 / 31	27	30	0	51	5	0	
Punjab 11 ...			29	3	0	59	7	0	
16-A ...			28	7	8	54	36	8	
Punjab 11 ...			26	38	8	66	27	8	
9-C ...			27	26	8	66	15	8	
Punjab 11 ...			26	37	0	67	18	0	Whole crop in ½ area suffered for want of water.
C-2 ...			28	0	0	70	26	0	Ditto ditto.
Punjab 11 ..			29	14	0	76	22	0	
C-3 ...			27	32	0	62	18	0	⅓rd crop in plot No. 12 had nearly dried up and the rest had badly suffered for want of water.

Statement J.

SHOWING THE AVERAGE OUTTURN OF SCOTCH POTATOES AND THE NET PROFIT PER ACRE AS COMPARED WITH THE LOCAL (SIMLA HILLS) POTATOES.

Name of place and No. of field.	Scotch potatoes. Average outturn per acre.	Scotch potatoes. Profit per acre.	Desi potatoes. Loss per acre.	Desi potatoes. Average outturn per acre.	Desi potatoes. Profit per acre.	Desi potatoes. Loss per acre.	Net gain to grower by growing Scotch instead of Desi potatoes.	Remarks.
	Mds. Srs. Ch.	Rs. A. P.		Mds. Srs. Ch.	Rs. A. P.		Rs. A. P.	
Pajog No. I ...	127 16 0	501 8 0	...	87 9 0	287 3 0	...	214 14 0	Soil shale.
Pajog No. II ...	125 25 0	490 5 6	...	75 38 0	229 12 0	...	260 9 6	Ditto.
Kufri No. I ...	81 16 0	17 10 0	...	19 9 0	..	40 3 0	57 13 0	Soil clayey.

Report on Milling tests of wheats at the Pioneer Flour Mills, Shahdara, in November 1919.

THE objects of the milling tests are to get—

(*a*) an idea of the best possible outturns that could be got from our different types of wheat in commercial mills,

(*b*) a comparison of the qualities of the products from the different types, and

(*c*) a clearer knowledge of the characters of wheats which influence their value from a miller's point of view and of the relative values of these characters to the miller.

Data on these points are required in order to assist us to compute the relative economic values of the types to the province and to guide us in our further work of wheat improvement in the Punjab.

In 1918 some milling tests were made at the Delhi Flour Mills, Delhi. Mr. G. A. Ball, Manager of the Delhi Flour Mills, conducted these milling operations for us, and it would have been an advantage, in view of his experience with our wheats, to have had him conduct the tests in 1919. Mr. Ball, however, went home on leave in 1919. As the Pioneer Flour Mills, Shahdara, are good mills and much nearer Lyallpur, we asked Malik Girdhari Lal, the managing agent of these mills, if we could have our 1919 tests made there. We showed him the report of the 1918 milling tests and explained what we wanted done. We explained that as the different qualities of flour which meet to make up "Straight run" flour come off machines, stretching all the way from the first break to the tail end of the mill, it was important for our purpose that part of the machinery should be stopped at the end of each lot while the remaining machinery was clearing itself of the stock. The managing agent kindly agreed to do this and to help us in every possible way to get the information which we wanted.

Mr. W. Hare, the mill manager of the Pioneer Flour Mills, Shahdara, also agreed to help us in every possible way. He is man of life long and wide experience of milling. He has milled wheats in different parts of England and Ireland, in Western Australia, in Bombay, Cawnpore, Ambala and Sindh. His skill as a miller is testified to by the fact that the well-known firm of Milling Engineers Henry Simon, Limited, employed Mr. Hare to start a number of milling plants for them both at home and abroad. We therefore decided to have our 1919 tests made at Shahdara.

2. *Types of wheats and amounts of grain milled.*—500 maunds or over of each of types 8 A, 8 B, Pusa 12, Punjab 11, Punjab 14 and Punjab 17, and smaller quantities of 9 C, 17 B, 20 C, Cross 2 and Cross 3 were collected in the mills. The whole consignment amounted to 3,574 maunds and 16 seers.

For the exact amount of grain of each type collected and details of the places from which we got the grains kindly see statement A appended.

3. *Colour of skin and general textures of grains of types sent to the mill.*—The colours of the skins and general textures of the grains of the types milled were as follows :—

Type No.	*Colour of skin.*	*General hardness of grains.*
9 C.	Amber	Hard.
8 B.	Do.	Do.
8 A.	Do.	Moderately hard.
Punjab 17	Do.	Do. do.
17 B.	Deep Red	Do. do.
Cross 3	Light Amber	Do. do.
Cross 2	Do. do.	Do. do.
20 C.	Do. do.	Do. do.
Punjab 14	Red	Do. Soft.
Punjab 11	White	Do. do.
Pusa 12	Do.	Soft.

4. *Order of merit from a milling point of view as judged from hand samples.*—Small samples of grains were examined by Mr. Hare. He placed the samples in the following order of merit from a milling point of view :—

White wheats { 8 A. } equal. / 8 B. } equal. / Pb. 17. / 9 C. / Pusa 12. / Cross 3. / Cross 2. / 20 C. / Pb. 11.

Red wheats { 17 B. / Pb. 14.

It will be noticed that the first four are the same wheats, and in the same order as in Major Gwynn and Mr. Ball's list last year.

Mr. Hare has placed Pusa 12 higher than any of the three millers who examined the wheats last year.

The large size of the grains attracted his attention. They tend to be little ordinary sized grains when lying alongside of them and to make them appear less well developed. However, as stated in my last year's report of milling tests sent to you with my unofficial letter No 440, dated 8th May 1919, the grain cleaning machinery in ordinary commercial mills is now fitted with great exactness to deal with ordinary sized grains from the world's great markets, and although one would expect a greater proportion of kernel to husk from big grains than from small ones, if other things are equal, it seems to me that in evolving wheats which are to meet the needs of these mills we must be careful that the grains are not too large.

In this milling test, a larger proportion of the grains of Pusa 12 came over the cleaning riddles with the larger foreign bodies than in the case of any other wheat, but the amount was not serious. Mr. Hare, however, stated that if barley had had to be separated from Pusa 12 it would have been an extremely difficult process. Realising this difficulty we have in past years thrown out quite a number of crosses which had abnormally large sized grains.

Mr. Hare was of opinion that Pusa 12 would not take up as much moisture in the conditioning process as harder wheats would, but that its flour would be very white and consequently that it would be a good wheat for blending with other wheats although not good for milling by itself. He also stated that soft wheats like Pusa 12 are more liable to weavil than hard wheats, but that he was judging the well grown and well preserved sample of grains set before him.

There is little to be said about the grains of the remaining types of wheat.

As regards the red wheats, he considered 17 B much better than Punjab 14. It is a harder wheat and its grains are more consistent in texture. Like the millers who judged the grains from the same wheats last year he considered these the finest he had seen in India.

Mr. Hare agreed entirely with the remarks regarding value of texture, colour and size of the grains, made in paragraph 6 of my last year's milling report.

5. *Weights and sizes of individual grains.*—We have a certain amount of data on the weights, volumes, lengths, breadths, etc. of the grains of each of the above types and hope to get samples of grains from other countries for comparison with ours.

A great deal of time and trouble is necessary to get good data on these points as many sizes of grains are to be found in samples of wheats, even when they have been grown on lands, and in seasons which allow them to reach their normal degree of development. In practically all cases the lower grains in a spikelet of a wheat head are larger than those higher up and the grains from the spikelets at different heights on the head usually differ in size. When, however, a wheat is grown in fair conditions the grains have a fairly constant and characteristic series of sizes, shapes, etc.

We have not had staff enough to get the data. We want from a sufficient number of samples to allow us to speak with much confidence so the figures to hand are not inserted in this report.

As, however, Punjab wheats are commonly found more or less mixed with barley and the machines which separate the barley from the wheats grains work chiefly on the greater length of the barley grains we may state that in ordinary Punjab barley many grains were found measuring from 0·29 inches upwards in length, and that none of our wheat types should therefore contain an appreciable proportion of grains as long as 0·29 inches.

Punjab 11 seems to be about the smallest grained of our types. The grains which we measured ranged between 0·25 and 0·27 inches in length as a rule. The grains of Punjab-14 so far examined were rather bigger, while 8-A, 8-B, Punjab 17, 17-B and 9-C seem to have a good many grains between 0·28 and 0·29 inches in length, and very few grains longer than that In Pusa 12, however, there are evidently a good many grains between 0·29 and 0·3 inches long but just what the proportion of these is contained in average, and good sample has not yet been ascertained.

The easiest method of getting useful information on whether barley grains can be separated from Pusa 12 and other wheat types would probably be got from a practical test on a barley separating machine, and I am therefore trying to arrange for small consignments of grains of our wheats mixed with known weights of barley, to be passed through a separating machine. We hope however that our measurements of lengths, breadths, volumes, etc., will help us to get a better idea of an ideal wheat grain and enable us to select types with more accuracy before they come to the stage of yielding large consignments of grain.

6. *Weights per bushel of the grains.*—As the weights per bushel of wheat grains is considered some indication of the value of the grains to a miller I give below the weights per bushel of our wheats after coolies had roughly cleaned all to about the same extent :—

Type No.	*Weight per bushel.*
	Lbs.
8-B	65¼
8-A	64¾
Pb. 17	64¾
9-C	63⅝
17-B	64¼
Pb. 14	64¼
20-C	64
Cross 2	63¾
Cross 3	63½
Pusa 12	63¼
Pb. 11	63

The weights in most cases are very near what they were last year. 60 lbs. is the standard weight of a bushel of wheat in England. I may note here also that the New South Wales wheat harvest 1918-19 was considered a first class one and that the weight of grains per bushel was 62½ lbs. It is also stated that in the record harvest in New South Wals 5 years ago the weight per bushel was 64 lbs (see "Milling," page 260 dated 6th September 1919).

Canadian wheats in 1918 ranged from 63 to 65 lbs. per bushel.

There, therefore, seems nothing very far wrong with our wheats as far as weights per bushel are concerned.

7. *Refractions.*—The refractions from our wheats at the mill consisted of weed seeds, wheat grains which were light, small, broken, oversized, etc., stones, chaff, dust except that taken out of the water stream where grains were being washed for the conditioning bins and skins of grains taken out by the whizzer. From statement B it will be seen that the total weights of these refractions varied from 1·21 to 1·53 per cent. of the weights of the consignments. Much of these wheats were grown by ordinary zamindars who thrashed them on the land by bullocks and cleaned them in the ordinary zamindari way. We had about the same percentages in our wheats milled last year, therefore higher percentages of refractions in wheats are evidently due either to sheer carelessness or fraudulent treatment.

8. *Treatment of the types when being conditioned for the mill.*—Our wheats being very various in texture require very different treatments as regards addition of moisture and storage after washing to bring them to the condition to give their best results in the mill. They were all new to Mr. Hare so I gave him the records of the conditioning treatments which the types got and the results which were obtained by these treatments in the milling tests at Delhi last year. Last year's milling tests being the first, and the lots of grains being small, we were not able to arrive at correct conditioning treatments in all cases and as the Pioneer Mills had rather different arrangements for washing the grains I suggested that a trial run on 100 maunds or so might be made on each lot, and then treat the remaining 400 to 500 maunds of each lot in the light of experience gained.

This was found impracticable, however, in running a commercial mill the Mill Manager has to time his different operations so that he may always have ready for the grinding machinery, at the proper moment, a stock of wheat cleaned and washed, and which has lain in the conditioning bins the correct number of hours to bring it to the proper state for milling; and as our types require very different treatments in the washer and lengths of time to lie in the bins, the grinding and dressing machinery would have had to lie idle when one type of wheat had to lie longer in the bins than another preceding it. One way of avoiding this loss would have been to have some of the ordinary wheat used by the mill ready to fill the gap, but as the number of conditioning bins was limited and Mr. Hare had altered his machinery to suit our work rather better, this could not be done. He had therefore to run the mill on our wheats alone and do the best he could.

It will be seen from the remarks column of statement C that only 2 types of wheat, *i.e.*, Punjab 11 and Punjab 14, were correctly conditioned. This is probably because they are common Punjab wheats and form a large proportion of the mixtures of types of wheats which commercial mills in the Punjab deal with. The other types which we milled were either underconditioned or overconditioned and this of course materially affects the weights an qualities of the products got from them.

9. *Comparative amounts of water which the grains of the types absorbed in the conditioning process and the amounts of moisture in the milled products.*—As explained in the last year's milling report a point of great importance to a miller in choosing a wheat is the amount of water which it will take up in the process of conditioning it correctly for the mill, and consequently it is important for the botanist to keep this in view in attempting to evolve improved wheats.

As last year, I wished to know the moistures in the different products of wheats to give us some indication of the proportion in which the weight of each of these products is increased by the water added when conditioning the grains ; to show any overdampness of these, and to act as a check on the accuracy of the total weights of the products got.

I made the moisture estimations myself last year, but as I found it was too much for me to attempt again, and the Chemical Section has special facilities for this sort of work, I arranged with the Agricultural Chemist to have that work done there.

For these estimations the undressed unwashed grains were collected as they were entering the dressing machines; the conditioned grains were collected as they were entering the first break rolls; and the bran, "sujis," flour and "ata" as they fell from the mill. All were immediately placed in glass stoppered bottles, locked in a special packing case, and sent to the Agricultural Chemist each day by a special messenger. The moisture estimations got from the Agricultural Chemist are embodied in statement C attached.

The figures sent to me show that the percentages of moisture in the whole undressed unwashed grains are lower than I found in the undressed unwashed grains of these types last year. This may be due to the summer of 1919 being drier than that of 1918, but there are much bigger differences between the moisture contents of the different types than I found last year and I cannot understand this.

There are several other points which I cannot understand in the moisture figures supplied to me, for example, it is impossible that there can be more moisture in every product that came from a wheat type than was contained in the conditioned grains from which they were made. Judging from last year's experience the unbroken grains at least seem to me to have lain too short a time in the oven to dry them properly. Perhaps this may be the explanation.

If the material was merely too short a time in the drying oven, then we might expect the figures in column 5 of statement C (water taken up during the conditioning process) to have some value, for they are the differences between the figures in columns 3 and 4 of the same statement, and although by our hypothesis neither the unwashed nor the conditioned grains were dried sufficiently, both might possibly have been dried to nearly the same pitch, and consequently the differences between them might be about the same as if both had been completely dried. Quite a number of things might make such results unreliable however.

Looked at in this way we find that Punjab 14 which was correctly conditioned both this year and last year, took up 5·53 per cent. of moisture in the conditioning process last year, and 5·48 per cent. this year (*cf.* column 5 of statement C of this year's report and column 5 of statement B of last year's report).

Also we find that Pusa 12 when correctly conditioned last year, took up 3·01 per cent. of moisture and was overconditioned this year with 4·26 per cent. of moisture. These results therefore are about what we expected.

Punjab 11, however, has taken up a much larger amount of water this year than last year's results would lead us to expect, but surely the natural moisture in its grain was more than 3·948 per cent.

The other types were not conditioned nearly correctly enough either last year or this year to allow us to draw further conclusions about them than that they obviously require much more water than Pusa 12 to condition them properly.

I fear that moisture estimations will have to be made on materials from a further milling test before we can say much more on this point.

10. *Weights of products got from the mill.*—Statement D appended gives the details of the weights of products got from the mill.

As already stated one of our objects in estimating the amounts of moisture taken up by the grains of each type in the conditioning process was to enable us to check the accuracy of the weights of these products got. The moisture figures are a check, because the net weight of dressed grains milled, plus the amount of moisture taken up during the conditioning process should be equal to the weight of products got from the mill, minus a small percentage of moisture evaporated, and dust lost during the milling operation. In mills in Britain this milling loss is calculated at about 1·5 per cent. The extent of the loss obviously depends on the temperature and humidity of the atmosphere as well as on the type of mill used, consequently I would expect this loss to be higher as a rule in the Punjab than in Britain. Our wheats were milled in November, however, and I am informed that the loss during milling should not exceed 2 per cent.

Examining our data from this point of view we find the following :—

Type No.	Net weight of cleaned dressed unconditioned grains milled.		Moisture absorbed in the conditioning process.		Total weight of conditioned grains entering the first break.		Total weight of products got from the mill.		Loss in weight of stock in the milling process.		Per cent. loss in weight of stock in milling process.
1	2		3		4		5		6		7
	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	
Pb. 14 ..	487	6	26	20	513	26	483	33	29	33	5·80
Pusa 12 ...	659	33	28	12	688	5	669	9	18	36	2·74
Pb. 11 ..	511	1	36	16	547	17	539	27	7	30	1·39
8-A	573	8	31	36	605	4	586	33	18	11	3·10
Pb. 17 ...	495	19	25	12	520	31	517	7	3	24	0·69
8-B	598	26	22	4	620	30	618	1	2	29	0·43

The figures for column 3 are based on those of column 2 of the above statement, and column 5 of statement C. The figures for column 4 above are got by adding the figures of columns 2 and 3. According to the above figures there was a milling loss of only 0·43 per cent. in the case of 8-B while the loss in the case of Pb. 14 was 5·8 per cent or over 13 times as much. This is amazing.

All the types dealt with were milled, one after the other, on the same machinery, between 3rd and 8th November and there was no appreciable change in the weather, therefore the figures of milling loss even in the cases of the other types seem to me to vary far too much for accuracy as regards outturns. For example we notice in the case of Pb, 14 that 487 maunds 6 seers of cleaned dressed and unconditioned grains went into the mill and only a total weight of 483 maunds 30 seers of products came out of it, Pb. 14 was just right conditioned and it must have taken up at least 5 per cent. (*i.e.*, 25 maunds approximately) of moisture in the conditioning process (*c.f.* statement C attached and also paragraph 11, page 9, of last year's Milling Report). Therefore whatever may be said of the moisture figures, the outturn figures seem to be wrong quite independently.

The accuracy of the weights of grains that went into the Shahdara mill and of the products which came out of it can hardly be doubted, for records were kept by both the milling staff and my own staff, and were checked by both Mr. Hare and myself while the work was going on. The deficient material therefore seems to have stuck about, the multitude of spouts in the mill and the angles of the various machinery. Pb. 14 was the first type to be milled and the mill had been well cleaned out before our work started. Also as it was found when the work began that the miller could not afford to run the machinery without a feed long enough to clear itself really well, we would expect a greater deficiency in its case than in the cases of the types which followed if our explanation is correct. The figures of milling losses for the other types bear this out (see the statement above). If we consider the total weights of conditioned grains entering the first break, and of the milled products, as given in columns (4) and (5) of the above statement we find that the milling loss on the whole quantity milled was 2·03 per cent., and if we leave out Pb. 14 in consideration of the fact that it was the first lot milled after the mill had had a special cleaning out which probably caused some of Pb. 14 to remain about the angles of spouts and machinery, we find that the milling loss on the total remaining types comes to 1·7 per cent. This looks very like what we should expect in the circumstances.

However, as there is some doubt about the accuracy of our moisture figures; as the amounts of stock which stuck about the milling machinery, etc., apparently varied to an extent that caused inaccuracies of over 1 per cent. in the weights of products got; and as the conditioning of the grains was obviously wrong, the outturn figures in the above statement cannot be taken as representing what the types may be expected to yield when properly milled We are therefore forced back to an opinion from the miller as regards probable yields of flour, bran, etc., from these types.

My own experience, meeting millers purchasing grains in markets, is that a good man can give a very shrewd opinion of the comparative milling outturns of different samples of grain by simply examining them in the hand, and a miller, who has actually milled about 600 maunds of each of these types, is in a much better position to give an opinion.

If "straight-run" flour, "ata," and bran only are taken from the grain as was taken at Shahdara, the miller knows that "straight-run" flour and "ata" come from spouts and machinery stretching from one end of the milling machinery to the other, while bran comes of only near the break rolls; therefore that although the error on the outturns of flour and

"ata" from 600 maunds of grain may be considerable because of material lying in the spouts and machinery, the outturn of bran got can include no such error He sees whether he has cleaned the bran of flour as well as could be expected in ordinary milling practice, etc., etc., and so has a very accurate knowledge of the percentage of bran which that type of wheat should yield. By carefully watching the behaviour of each type for a 6 or 7 hours' run on the mill he should also have a fair idea of how they will turn out as regards flour and "ata."

Mr. Hare is, as I have already stated, a miller of long and wide experience and I think an opinion from him should be of value.

11. *Estimated yield of straight-run flour.*—In his opinion the maximum yields of straight-run flours would be as follows:—

8-A, 8-B —72—74 per cent.

Pb. 17—73 per cent.

Pb. 11—70 ,,

Pusa 12, Pb. 14 —68 to 70 per cent.

This is the same order as the types were put in last year for flour yields at Delhi; only 8-A and 8-B were there expected to give up to 75 per cent. of flour.

12. *Bran.*—The percentages of bran expected by Mr. Hare are—

8-B, 9 C., Pb. 17, 3-A., C-2, Pb. 11., 17-B. — Say 15 per cent.

Pusa 12., Pb. 14. — Say 20 per cent.

Any discrepancies between that estimation and the actual yields recorded on statement (D) attached are due to expected differences when the miller becomes well acquainted with the types and can set the machinery correctly for them.

13. *Regarding "suji" (semolina)* —Mr. Hare thinks the maximum yields of "suji" would be about as follows:—

8-A, 8-B, 9-C —25 per cent.

Pb. 11— 10—15 per cent.

Pb. 14, Pusa 12. — Absolutely unfit for "suji" making.

As regards colour, he placed the "sujis" in the following order:—

8-A.

Pb. 17.

8-B.

9-C.

17-B.

Cross 2.

Pb. 11.

Pb. 14.

Pusa 12.

14. *Pekars' test for colour of flour.*—As explained in paragraph 15 of last year's Milling Report Pekar's test of the colour of flour consists of placing small samples of flour side by side on a piece of board; smoothing the surfaces of the samples with a piece of glass; dipping the board loaded with the flour under water and judging the colours after the flours have dried in ordinary atmospheric conditions. When flours from properly conditioned wheats are treated in this way some idea is got of the colours that they will give after being baked.

The order in which Mr. Hare placed the flours after Pekar's test was as follows :—

Pusa 12

8-A

Pb. 17.

Pb. 11.

9-C.

17-B.

8-B.

Pb. 14.

Cross 2.

Pusa 12 has a very white coloured flour. This, as I explained in paragraph 14 of my last year's Milling Report, is, I believe, due to softness of its grain. We will look further into this point as soon as possible.

15. *Chemical analyses of the grains and their products.*—I hoped to have had analyses of the grains of these wheats this year showing the albuminoids, starches, fibre, etc. which, they contain, to be the start of a series of similar analyses made annually for some years to show within what limits we may expect the composition of the grains of a type to vary and by correlation of the conditions under which they were grown to help us to understand the causes of the variation. I also hoped to have had similar analyses of the various milled products to show the distribution of the constituents of the grain among these ; difference in economic value between products from different types, etc., etc. Unfortunately, however, the Agricultural Chemist has not had time to make the necessary analyses. We hope that we may get these analyses when further milling tests are made.

16. *General remarks on the season's work.*—I am very sorry to say that the work under report is not nearly as far on as I had hoped to have it by now, but it is pleasing to note that what we have been able to do, indicates again that there are big differences between the values of the grains of these types of wheat, and that we may hope for some degree of constancy in these differences. What is equally important, we are also getting a clearer knowledge of the characters of the grains and of what is required of us to produce improved types.

17. *Future milling tests.*—It seems to me that if we are to have further tests made in commercial mills we must either allow the machines to clear themselves more thoroughly than was done at Shahdara or the quantities of grain must be larger before we can get reliable outturn results on such a mill. This mill is of ordinary size and dealt with 70—80 maunds of our grains per hour, so that we had a 7 or 8 hours run on each lot of 500 or 600 maunds.

That quantity of grains is larger than we should usually have to provide for milling tests if we are to eliminate the less valuable types of wheats from our experiments as soon as possible and save our land and staff for pushing on the most valuable sorts.

I have therefore come to the conclusion that we should have a small milling plant for our testing work, and I have asked for such a plant in a separate letter No. 1425—43-81, dated 10th April 1920.

18. *Acknowledgments.*—In conclusion, I wish to acknowledge my indebtedness to Malik Girdhari Lall, Managing Agent for the Pioneer Milling Company, Shahdara, and Mr. Hare, Mill Manager, who did all in their power to meet our requirements, and certainly gave up as much of the time of their mills and staff as could be done with shareholders examining their log books and with orders coming in from customers for special products to be delivered at once, which our work prevented them being able to respond quickly to Mr. Hare also placed his special knowledge as a miller most unreservedly at our disposal and gave us much valuable advice and information.

D. MILNE.

OFFICE OF THE ECONOMIC BOTANIST TO GOVERNMENT, PUNJAB,

Dated Lyallpur, the 3rd April 1920.

MY DEAR HARE,

HEREWITH a copy of my milling report. Kindly inform me if there is anything in it which you object to, or anything which you can suggest to improve it.

Kindly also consult your Managing Agent, Lala Girdhari Lall, on the case.

An early reply will much oblige as the report is long due to Government now.

All good wishes,

Yours sincerely,
D. MILNE.

Statement A.

SHOWING THE TYPES OF WHEAT MILLED IN THE PIONEER FLOUR MILL OF SHAHDARA, THE AMOUNTS OF THEIR GRAIN AND PLACES FROM WHICH THEY WERE OBTAINED.

Type No.	Botanical Section, Lyallpur.		Lyallpur Agricultural Section.		Chak No. 213, R. B., Lyallpur.		Chak No. 258, R. B., Lyallpur.		Sargodha Seed Farm.		Chak No. 132, S. B., Sargodha.		Gurdaspur Agricultural Farm.		Ramdawari in Gurdaspur District.		Gangapur in Lyallpur District.		Total.	
	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.
8-A	0	0	152	20	0	0	0	0	0	0	485	0	0	0	0	0	0	0	637	20
8-B	0	0	152	20	454	20	0	0	6	0	60	0	0	0	0	0	0	0	667	0
Punjab 17	0	0	0	0	0	0	502	20	0	0	0	0	0	0	0	0	0	0	502	20
Punjab 11	105	0	6	0	297	38	112	20	0	0	0	0	0	0	0	0	0	0	515	18
Punjab 14	0	0	0	0	0	0	0	0	0	0	0	0	4 5	0	0	0	0	0	495	0
Punjab 12	11	8	0	0	0	0	6	0	0	0	0	0	16	30	90	0	410	0	679	38
9-C	9	5	0	0	0	0	0	0	16	15	0	0	0	0	0	0	0	0	25	40
17-B	12	20	0	0	0	0	0	0	12	20	0	0	0	0	0	0	0	0	25	0
20-C	6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	20
Cross 2	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0
Cross 8	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
Total ...	164	13	305	0	752	18	615	0	28	35	545	0	663	30	90	0	410	0	3,574	16

Statement B.

SHOWING THE TOTAL WEIGHT OF UNCLEANED UNDRESSED WHEAT GRAINS PUT INTO HOPPER AND THE AMOUNTS OF REFRACTIONS GOT FROM THE CONSIGNMENTS BEFORE WASHING THE GRAINS.

1	2			3			4
Type No.	Total weight of uncleaned undressed grains put into hopper.			Total weight of refractions.			Per cent. of refractions.
	Mds.	Srs.	Chks.	Mds.	Srs.	Chks.	
Punjab 14	493	35	0	6	29	0	1·36
Pusa 12	168	5	4	8	11	10	1·23
Punjab 11	513	23	12	7	22	11	1·43
8-A	638	8	0	7	31	6	1·21
Punjab 17	502	39	8	6	25	2	1·31
8-B	654	26	4	10	0	2	1·53

Statement C.

SHOWING THE PERCENTAGES OF MOISTURE LOST IN A STEAM OVEN AT 98° C. FROM THE WHEAT GRAINS IN THE CONDITIONED AND UNCONDITIONED STATES, AND FROM THE PRODUCTS WHICH THEY GAVE IN THE MILL; ALSO SHOWING THE PERCENTAGES OF MOISTURE GAINED DURING THE CONDITIONING PROCESS AND THE PROXIMITY OF THE LOTS TO THE IDEAL CONDITION FOR MILLING.

Type No.	Date of milling.	Whole undressed unwashed grains.	Conditioned grains entering 1st break.	Per cent. of moisture absorbed during the conditioning process.	Bran.	Coarse suji.	Fine suji.	Straight-run flour.	Coarse ata.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
Punjab 14 (1st lot)	4th November 1919 ...	5·98	11·46	5·48	11·96	13·23	12·938	11·672	11·11	Just right conditioned.
Punjab 14 (2nd lot)... ...	Ditto ...	5·98	11·42	5·44	11·856	12·41	12·736	12·280	10·668	Rather dry in centre of grains; lay only six hours in conditioning bin instead 16 hours as in case of 1st lot; otherwise same treatment.
Pusa 12 (1st lot)	Ditto ...	7·84	12·336	4·496	12·882	...	...	12·402	10·758	Overconditioned; lay 5½ hours in conditioning bin.
Pusa 12 (2nd lot)	5th November 1919 ...	7·84	12·1	4·26	16·130	12·520	12·490	11·720	12·944	Overconditioned considerably; lay 19 hours in conditioning bin instead of 5½ hours as in case of 1st lot; otherwise same treatment.
Punjab 11 (1st lot)	Ditto ...	3·948	11·994	7·046	12·570	12·790	12·280	12·240	11·296	Rather dry in centre of grains. It lay 7 hours in conditioning bin.
Punjab 11 (2nd lot)... ...	6th November 1919 ...	3·948	11·208	7·260	12·628	11·760	12·620	12·200	12·280	Just right conditioned. It lay 19 hours in conditioning bin; otherwise same treatment as in 1st lot.
8-A (1st lot)	Ditto ...	4·54	9·768	5·228	11·720	12·144	11·884	11·808	11·460	Underconditioned by long way; lay in conditioning bin 20 hours.
8-A (2nd lot)	Ditto ...	4·54	10·468	5·928	11·876	12·030	11·810	11·592	10·148	Underconditioned by a long way; lay in conditioning bin about 23 hours; otherwise same treatment as 1st lot.
8-A (double wash)	8th November 1919 ...	4·54	14·728	10·188	15·780	16·102	15·356	13·304	12·252	Overconditioned considerably; double washed.
Punjab 17 (1st lot)	7th November 1919 ...	5·924	11·04	5·116	13·380	13·372	13·424	13·276	12·528	Underconditioned; lay in conditioning bin 21 hours.
Punjab 17 (2nd lot)... ...	Ditto ...	5·924	11·05	5·126	12·992	13·290	12·824	13·010	12·468	Underconditioned; lay in conditioning bin 28 hours; otherwise same treatment as 1st lot.
8-B	Ditto ...	6·516	10·292	3·776	12·254	12·220	12·414	11·720	11·500	Underconditioned by a long way; lay in conditioning bin 21 hours.
8-B (double wash)	8th November 1919 ...	6·516	15·736	9·220	17·918	16·718	16·192	12·802	13·000	Overconditioned considerably; double washed.
9-C	7th November 1919 ...	5·586	10·756	5·170	12·060	12·614	12·472	12·328	11·754	Underconditioned by a long way; lay in conditioning bin for 8½ hours.
17-B	8th November 1919 ...	5·58	10·274	4·694	12·356	12·768	12·744	13·458	12·156	A little dry.

Statement D.

SHOWING THE AMOUNTS OF GRAINS MILLED, THE AMOUNTS OF THEIR PRODUCTS AND THE PERCENTAGES OF PRODUCTS.

1	2	3			4			5			6			7			8	9	10
Date of milling.	Type No.	Net weight of grains milled.			Weight of straight-run flour.			Weight of coarse ata.			Weight of bran.			Total weight of products got.			Percentage of flour.	Percentage of ata.	Percentage of bran.
		Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
3rd-4th November 1920.	Punjab 14 ...	487	6	0	271	35	0	111	30	8	100	8	0	483	33	8	56	23	20
4th-5th November 1919.	Pusa 12 ...	659	33	10	409	4	0	138	31	0	120	23	0	669	9	0	61	29	19
5th-6th November 1919.	Punjab 11 ...	511	1	1	322	20	0	134	19	8	82	24	6	539	27	4	60	25	15
Ditto.	8-A ...	573	8	10	311	29	0	185	26	0	89	18	6	586	33	6	53	32	15
7th November 1919.	Punjab 17 ...	495	19	2	258	36	0	172	29	0	85	22	12	517	7	12	50	33	17
7th-8th November 1919.	8-B ...	598	26	2	283	26	0	236	7	0	93	8	6	618	1	6	46	38	16

Report of the Rawalpindi Baking tests of the flours from the wheats milled in November 1919 in the Pioneer Flour Mills, Shahdara.

2. *The Supply and Transport School of Bakery, Rawalpindi.*—Through the kindness of Colonel Davis, Director of Supply and Transport, Rawalpindi Division, samples of "Straight-run" Flour from the wheat types milled at Shahdara, were baked in the Supply and Transport Training School of Bakery. Rawalpindi, in February 1920. About 15,000 1 lb. loaves of plain white bread such as is used in Britain are baked daily in this bakery and issued to the European troops and officers of the station. Bakers and neaders are trained there for the Divisional Reserve Establishment and British and Indian commissioned and non-commissioned officers are trained to supervise, or take charge of bakeries. Conductor Hughes, who is at present in immediate charge of the Baking School, is the son of a baker and has a very thorough knowledge of bread baking which he put entirely at our service.

2. *Quantities of flour used.*—4 maund samples of flour of the more important wheat types were taken to the Bakery. In the case of other types ½ maund to 2 maund samples were taken. As most of our wheats were not correctly conditioned when milled we did not take larger quantities of flour to Rawalpindi.

3. *Remarks on the method of making the bread.*—The bread was made in the ordinary way that plain bread is made in the bakery. Yeast from brewer's malt was used for raising the bread and no flavouring substance was employed. The temperature of the baking oven was about 5,000 F. We have careful notes of all details of the process of making the bread but these need not be given here.

4. *Number of loaves got per 100 lbs. of flour used.*—The average number of loaves got per 100 lbs of flour used after five separate bakings of each of the following 5 types were as under.:—

Type.	*Number of loaves per 100 lbs. flour used.*
8 B/1	142·0
Pb 17/1.	140·6
8 A/1	140·0
Pb. 14/1	139·6
Pusa 12/2	138·2

Pb 11/2 was baked on four of these occasions and gave an average of 139·25 loaves per 100 lbs. of flour used.

I may mention that the numerators in the above fractions denote the type of wheat; the denominators refer to the milling from which the flour was taken. Example Pb. 14/1 signifies type Punjab 14, first milling.

The yield of bread demanded by the Supply and Transport Department per 100 lbs. of flour issued is 135 one lb. loaves; 131 lbs. of bread are reckoned on in London, and 133 lbs. in Bristol from the same amount of flour. Our types therefore have done quite well in these tests.

Some of the newer types have done exceedingly well, but we will say more about them later.

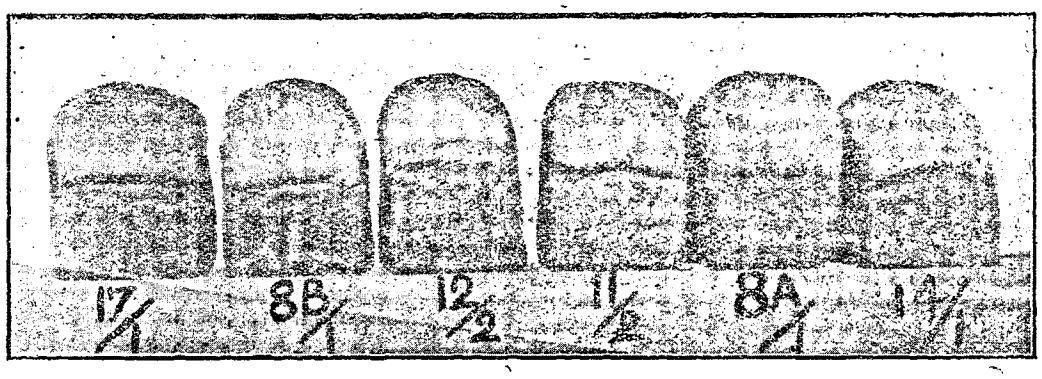
5. *Volume and other characters of the loaves:*—The volumes of 8 loaves from each of 3 bakings of each of the above types were taken, and the average results were as follows:—

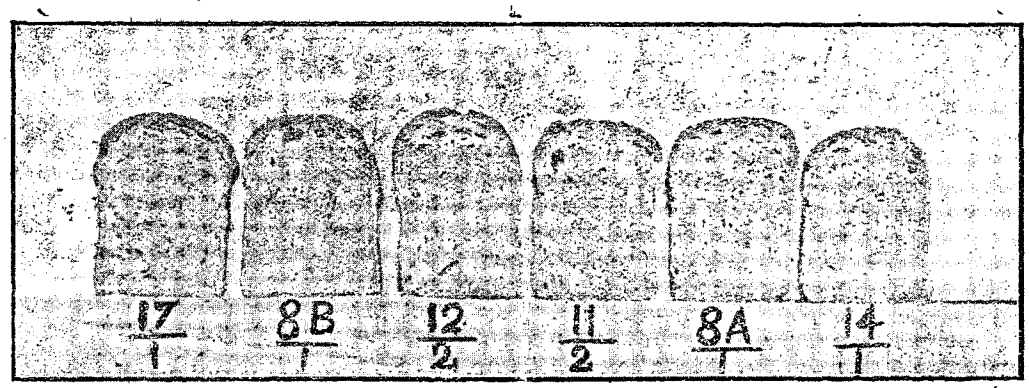
Type.	*Volume of 1 lb. loaf in c. c.*
Pb. 17/1	2,444
8 B/1	2,423
Pusa 12/2	2,406
8 A/1	2,245
Pb. 14/1	2,207
Pb. 11/2	2,187

Taking into consideration the main points on which a loaf is usually judged, *i.e.*, volume, colour of crust and crumb, texture, and flavour, every body concerned agreed that the flours all made 1st class bread.

Photos. of (*a*) the whole loaves, and

(*b*) slices of the loaves showing textures of the crumbs are attached.





6. *General remarks on baking.*—The object of the wheat breeder in associating himself with baking tests is to discover how far differences in the results got by the baker from different flours are due to inherent characters of the grains, and how far merely to differences in treatment of the flour at the bakery. A knowledge of this is necessary so that he may take advantage of anything good in the former, and not be misled by the latter.

We have not gone far with our baking work yet, but I have seen that the number of loaves per 100 lbs. of flour can be materially increased or decreased while still producing good bread, simply by increasing or decreasing the amount of water added to make the dough.

The data being collected from the test on our flours also shows that the slacker doughs gave us the larger sized loaves, as well as the greater number of them from a given weight of flour.

Cracking of crust, we find is produced by a dry skin forming on the dough as it is "proving" in the mould, and cracking naturally tends to occur in doughs to which an insufficient amount of water has been added. Bakers cover the moulds with a damp cloth, while the dough is "proving" and so avoid the crakes. Our attention has also been attracted to a number of other points which it is premature to discuss here but obviously optimum results are got from different flours, not only by using different quantities of water in the dough, but by difference of treatment in other ways, and at this stage we merely give the above data with the remark they are the results got from very short tests on these flours by experienced bread bakers.

7. *Acknowledgments.*—Our warmest thanks are due to Colonel Davis, Director of Supply and Transport, Rawalpindi, for kindly allowing us to carry out the tests in the Divisional School of Bakery; to Major Thomas for placing every facility of staff and equipment at our disposal; and to Conductor Hughes for putting himself to a very great deal of trouble to fit our tests into the routine of his bread making work for the troops, and for his most generous efforts to give us all possible information that would help us to estimate the value of inherent characters of the flours from our wheats.

D. MILNE,

Economic Botanist to Government, Punjab, Lyallpur

Report on the investigations made into the connection of a pulse with cases of paralysis among people in Dera Ghazi Khan.

Identity of the plant.

WITH regard to the cases of paralysis in human beings reported by the Civil Surgeon, Dera Ghazi Khan, and suspected by him to be due to the people eating a pulse which is grown along with wheat, the plant supplied by him to us has been identified as *Lathyrus Sativus*, Linn. In the Punjab Vernacular it is commonly called Khesri.

Chemical Analysis of the seeds.

2. On 27th March 1919 when sufficient seeds were obtained from the Civil Surgeon, Dera Ghazi Khan, about 2 pounds of them were sent to the Agricultural Chemist here with an explanation of the case and the request that he might kindly examine them for any poisonous substance. Unfortunately he has not had time to take the work in hand.

Experiments on animals.

3. To throw some light if possible on whether the cases of paralysis mentioned had been caused by *Lathyrus Sativus* in Dera Ghazi Khan, some experiments have been conducted on pigeons, a dog and rabbits. The details are as follows :—

(*i*) On the 16th May 1919 six adult domestic pigeons were placed in an enclosure composed of a net wire run and a house for shelter. The floor of the run was earth and a good supply of water was given. The food supplied was exclusively crushed seeds of *Lathyrus Sativus*. Sufficient water to moisten the food was added to the crushed seeds 2 or 3 hours before being fed to the pigeons. The total weight of seed given among the six pigeons per day was about 1 pound. The food was given once a day, about 11 A.M.

For the first two days the birds did not seem to relish the feeds, but after that they ate them freely. They got this treatment till 10th July 1919 (*i.e.*, for 55 days) and as they did not seem affected the experiment was given up.

(*ii*) On 20th May 1919 a dog about one year old was chained to a kennel and fed on bread prepared from *Lathyrus Sativus* flour. The method of preparation of the chapatis fed to the dog was the same as for chapatis commonly used by the people here. As the dog did not eat the bread after two days' trial and no other food was supplied the Lathyrus flour was mixed with wheat flour in equal quantities and bread of the mixture was given. He began to eat this and continued on it. His bowels were regular and he appeared to do quite well till the experiment was discontinued on 15th August. The treatment in this case had therefore extended over 87 days.

(*iii*) From 30th May two domestic rabbits, each about 1½ months old, got a daily ration between them of 2 ozs. of Lathyrus seeds. Before being fed to them this was crushed and moistened in water. A little grass was also given. On 19th June about 1 P.M. one rabbit was seen to have a staggering movement when it attempted to run about. It evidently was unable to use its legs properly. Its head was drooping and the animal repeatedly fell on one side or the other. It died of paralysis about 2 P.M. the same day.

At about 4-30 P.M. that day also the second rabbit was found ill. Its symptoms were similar and it died at 5-15 P.M. These two rabbits therefore died after 30 days' dieting. Other rabbits of the lot from which these two were taken were fed on as near as possible the same amounts of grass and gram. These continued doing well.

The experiments on the dog and the rabbits were conducted in the veterinary hospital here, and the animals had been under the observation of the Veterinary Assistant Bh. Asa Singh. A copy of his report on the cases is attached herewith.

To confirm the results got with the rabbits a fresh lot of rabbits were put under experiment. The particulars are as follows :—

(*iv*) From 1st July two domestic rabbits about 2 months old got 2 ounces crushed Lathyrus seeds between them and a little grass daily as in the previous experiment. On 9th July one rabbit showed signs of paralysis of the limbs. It died about one hour after this was noticed. The Veterinary Surgeon attributed its death to paralysis. It therefore died after 9 days' dieting.

On 11th August at 5-45 P.M. the second rabbit was found ill. It was at once sent to Dr. Phillips, Civil Surgeon, Lyallpur, and he and the Assistant Surgeon Dr. Mathra Das, diagnosed the case as one of paralysis of the spinal cord. The rabbit seemed fully conscious and they thought that the brain was not affected. The limbs were of course affected as a result of the spinal paralysis. A copy of the report of the Assistant Surgeon is appended.

(*v*) On 20th November 1919 an experiment was started on two domestic rabbits, each about 8 months' old. Between them they got 4 ounces of seeds of Lathyrus Sativus once per day.

On 10th January 1920 one rabbit died as the result of paralysis of the limbs, *i e.*, after 51 days' dieting, and the second rabbit has not yet shown any sign of illness (*i.e.*, after 180 days' dieting). Two rabbits fed on the same crushed gram and grass are also quite healthy.

The seeds of Lathyrus Sativus used in all cases were supplied by the Civil Surgeon, Dera Ghazi Khan. I considered it necessary that this should be so, as there are cases of plants being poisonous when grown in one part of the world and not so when grown in another.

Occurrence of Lathyrus Sativus.

4. Lathyrus Sativus is found in the wild state practically all over the Province and is cultivated for fodder or grain in some districts. In these cases it is sown in October, November and ripens in March-April.

It seems to be cultivated to some extent throughout India as a cold weather crop. The chief areas are the Central Provinces and Sind, which between them appear to grow well over ½ a million acres (Compare Commercial products of India by Watt, page 704). The information is not very up to date however.

Lathyrism.

5. Lathyrism or paralysis which develops in human beings and animals as the result of taking the seeds of Lathyrus Sativus has been known for a long time in various parts of India. Some useful information is to be found on Lathyrism in—

(*a*) Watts Dict. Econ. Products, Volume IV, page 592.

(*b*) Watts Commercial products of India, page 705.

The subject is also dealt with by Dr. Voelcker in an article in "The Analyst" of May 1894, page 103, and by others. Watt in (*a*) above mentions it first in 1833, when it was suspected of causing many cases of sudden paralysis of the lower limbs among the people in the eastern villages of Sind. That year Lathyrus Sativus formed the chief food of the people in these villages. In various parts of India since then similar cases of paralysis of the limbs have been noticed occurring not only among men but among horses, cattle and sheep where Lathyrus Sativus seeds had formed a large part of the diet for a considerable time. I personally have met people in the Punjab who have stated that cases of paralysis among horses have often occurred when a vetch of the description of Lathyrus Sativus was abundant. There appears to have been over 7,600 people paralysed by it in the Central Provinces one year. No case affected with Lathyrism ever appears to recover.

Regarding the cause of Lathyrism

6. Just how Lathyrus Sativus seeds cause the disease seems to be still obscure. In the above quoted literature and elsewhere it has been suspected that it is caused by albumenoid fermentation ; or by a poisonous fungal parasite possessed by the pulse ; etc. etc., but the most popular idea seems to be that it is caused by a volatile alkaloid developed in the seed and which could be dissipated by heating. As the seeds of many near relatives of Lathyrus are known to possess poisonous alkaloids—for example the Laburnum (Cyslisus Laburnum), Furze (Ulex Europeus), etc., and this appears quite probable.

Watt in (*b*) above mentioned, however, says that investigations made at the Imperial Institute with a view to ascertain the nature of the poison gave negative results, but Dunstan pointed out that the seeds sent may not have been of the poisonous sort. Watt also says that there seem grounds for suspecting that the plant may be only intermittently poisonous. This is quite possible, and it is very probable that the seeds may be more harmful when grown under one set of conditions of soil and climate than when grown under another.

It should be noted, however, that the disease complained of by the Civil Surgeon, Dera Ghazi Khan, was caused by the crop grown in the winter 1917-18, while the seeds which produced the disease in the rabbits here were got from the crop grown in the winter of 1918-19.

Paralysis caused in sheep by Lupins.

7. In this connection I may note that when Lupins are fed to sheep cases of paralysis sometimes occur. Lupins and Lathyrus are not distantly related and there may be a similarity in the cause of the trouble in the two cases. In an article in the issue of "modern farming" of December 1919 the following passages occur:—

> "Lupins make a useful fold for sheep either when green or when the pods are just beginning to form, the shepherds usually preferring the latter condition. When folding considerable care must be taken or the sheep will suffer from a kind of paralysis which causes them to 'topple' over. Most Suffolk flock masters have had sheep affected in this way from time to time, but it would appear that the danger of death is not very great provided care is taken that the sheep never go into the Lupin field hungry and never have a chance of over-gorging themselves.

"It is important to begin folding on Lupins gradually especially if much seed is present in the green pods. Unfortunately the grain of Lupins like the plant contains a poisonous principle which renders it dangerous to feed to animals in large quantities. A Dutchman Boodt claims to have discovered a method of steeping whereby the poisonous substance can be removed."

The article also states that Mr. John Goddard finds that the maximum quantity of Lupin grain which can be fed safely to sheep is 1/3 lb. per head daily.

I have written to the Editor of "Modern Farming" asking for more information regarding the case.

Further investigations on Lathyrism.

8. The subject of Lathyrism is evidently a very important one in India, and I regret that owing to a severely limited staff and work requiring more urgent attention investigations regarding it have not had the vigorous attention and push which we feel they ought to have got.

Further sets of experiments should be carried out to show whether the seeds are equally poisonous in any year, and when grown under different conditions; whether other parts of the plant as well as the seeds are poisonous; what domestic animals are susceptible to Lathyrism, how long it is before it takes effect, and what proportions of Lathyrus in their diets they can stand without injury; whether males are more susceptible than females and young more than old as literature leads us to believe is the case, etc., etc. The animals should be suitably housed and proper control experiments should be arranged, the whole thing being on a scale sufficient to avoid misleading results.

The animals should be kept constantly under observation by some one who would report any change, all food should be examined by a competent person and given strictly in accordance with the requirements of the experiment. A Veterinary Surgeon or a medical man would have to visit the animals twice or thrice per day and be at hand at any moment when the animals showed symptoms of disease, to diagnose the case and make any necessary *post-mortem* examinations.

The assistance of a chemist is also necessary to confer with the Medical or Veterinary man and carry out whatever analyses may appear to be necessary to throw light on the case.

It would be a simple matter in these experiments to prove whether heating the seeds or food products from them to certain temperatures could render them harmless to animals, whether the poisonous action is confined to the outer layers of the seed or to the kernel, etc., etc. The question of whether paralysis is due to a deficiency in the diet as in the case of paralysis in Beri Beri, where people live too much on rice kernels, and many other points could also be looked into. We have not the staff or the facilities here to do all this thoroughly, and I therefore think that the case should be handed over to the Medical Research Department or to the Veterinary Department. I shall of course be only too glad to assist in the work in any way I can.

I am sending a sample of the Lathyrus seeds from Dera Ghazi Khan to the Imperial Institute, London.

Acknowledgments.

9. My warmest thanks are due to Lala Jai Chand, Assistant Professor of Botany here, under whom I placed the work and who looked after it at great inconvenience to himself; to Bhai Asa Singh, Veterinary Assistant, who housed some of the animals in the Veterinary Hospital and gave Veterinary attendance to all of them, to the late Dr. Phillips, Civil Surgeon, Lyallpur, and his Assistant Surgeon, Dr. Mathra Das, for examining diseased rabbits, and to the Civil Surgeon, Dera Ghazi Khan, for so kindly keeping me supplied with seeds of Lathyrus Sativus.

D. MILNE,

Economic Botanist to Government, Punjab, Lyallpur.

Reports of the Veterinary Assistant and the Assistant Surgeon.

THE two rabbits under experiment died of paralysis on 19th June 1919, one at 2 P. M. and the other at 5-15 P.M.

Symptoms of the disease :—

The rabbits could not stand and fell on either side. The brain especially was affected.

Death followed immediately after the appearance of the symptoms, which therefore could not be observed accurately.

ASA SINGH,

Veterinary Assistant,

Veterinary Hospital, Lyallpur.

19-6-1919.

I and Dr. E. Phillips examined the rabbit brought by you.

Its hind legs were paralysed owing to its spinal cord being affected. The seat of lesion was in the lumber region.

Its brain was quite healthy.

MATHRA DAS,

Assistant Surgeon, Lyallpur.

Statement of experiments carried out on pigeons, a dog and rabbits to ascertain the effect of feeding them on seeds of Lathyrus Sativus.

Animals experimented on.	Period for which experiment lasted.	Result.
1. 6 pigeons	16th May 1919 to 10th July 1919...	Apparently not affected.
2. Dogs.	20th May 1919 to 15th August 1919	Ditto ditto.
3. Two domestic rabbits 1½ months' old.	30th May to 19th June 1919 ...	One found paralysed on 19th June at 1 P.M. and died at 2 P. M. 2nd rabbit paralysed on 19th June at 4-30 P. M. and died at 5-15 P. M. (See Veterinary Assistant's report.)
4. The domestic rabbits 2 months' old.	1st July to 11th August ...	One rabbit found paralysed on 9th July and died on same day. Second rabbit found paralysed on 11th August and died same day. (See Assistant Surgeon's report.)
5. Two domestic rabbits 8 months' old.	(*i*) 20th November to present date, 20th May 1920.	One found paralysed on 10th January 1920 and died on the same day. The other rabbit still living. (20th May 1920.)

Annual Report of the Agricultural Chemist to Government, Punjab, Lyallpur, for the year ending June 30th, 1920.

The Ganji Bar Experimental Station.

Bara Reclamation.—The work at the Farm suffered considerably by the fact that changes in the staff had to be made just before Rabi sowings. Bhai Arjan Singh, who was suspended and subsequently reverted to his original post in the Chemical section, was replaced temporarily by Bhai Charan Singh, who gave over charge to Bhai Gurdial Singh in December.

The pacca buildings which have been sanctioned have not yet been constructed. It is hoped building will be taken in hand soon, as the work connected with the farm is carried out under considerable inconvenience under the present circumstances. Owing to shortage of staff in the Department for a large part of the year Bhai Gurdial Singh has been carrying on single handed. Much trouble has also been experienced in securing labour.

The results so far obtained by work on the farm must not be judged entirely by the outturn of crops, which is indeed miserable. The great difficulty of the work appears to be almost entirely dependent on the physical conditions of the soil, and it is only by a process of trial and error that experience will be gained which will indicate the best methods of cultivation. One result which is of great importance is clear from the statements which are published this year, and has been confirmed in this year's kharif crops. This is that treatment with gypsum has a marked effect in improving the texture ; in all cases the improvement so brought about is proportional to the amount of gypsum added. So far the heaviest application has been at the rate of two tons to an acre. Next year bigger doses will be applied.

The general scheme of the experiments was described at length in last year's report and need not be repeated here. So far the comparison of results obtained by cultivation with machinery and the Rajah plough cannot be made with any degree of certainty. It must also be remembered that the steam cultivation which it has at present been possible to perform has not been beyond a depth of about 9 inches. The tackle which was ordered in 1918 has now arrived, and will be utilized on the experimental plots in the Rabi sowings. It is hoped that a much clearer idea of the purely mechanical effect of deep cultivation may be gained by the time of next year's report. The effect of sowing in ridges was also tried this year but proved less successful than broadcasting or sowing in lines in the usual way. The experiments will however be repeated with other crops.

Besides the treatment of gypsum, which has already been referred to, the use of green manure is being investigated in combination with gypsum as well as alone. Unfortunately green manuring crops have been a total failure and even the small plots on which green manure, carted from outside, was ploughed in, were not successful owing to errors in treatment. The beneficial effect of adding organic matter to the soil has however been demonstrated this Kharif in the case of the application of castor cake in the cultivation of rice and will be reported next year. A similar difficulty has, however, been experienced in securing a green manuring crop.

On the experimental squares it was intended to use three crops with each of the treatments undertaken, namely, wheat, gram and turnips. Of these only wheat gave any results which can be utilized, the remaining crops being almost total failures.

In the following statement are given the details of cultivation and the outturn of the main experimental squares. In square 79, which is cultivated throughout only by bullock power, the most successful results were obtained by the use of gypsum, and the same was the case in square 88 which has been cultivated with machinery. In square 89 the residual effect of gypsum applied in 1918 is very marked. Square 73 is mainly described as Bari, and here also the same effect of gypsum is noticeable, although the applications were very much lighter. Heavier applications here will probably give better results. In square 72 the effect of applications of sand has been tested. Although from the figures for the outturn it will appear that the application has had a beneficial effect, the result cannot be relied upon, as the yield was almost entirely confined to those patches of the plot on which Tibbas had existed.

STATEMENT SHOWING THE RESULT OF WHEAT.

Statement showing the result of wheat.

Ganji Bar Experimental Station.

No. of square.	Plot.	Treatment.	Crop and variety.	Area sown.	Date of sowing.	Date of harvesting.	Actual outturn. *Grain.* Mds.	Srs.	*Straw.* Mds.	Srs.	Remarks.
79 Line A	1	Green manuring with san and gypsum 2 tons per acre	Wheat No. 11	4,840	18th November 1919	27th April 1920 ...	1	32	3	4	Rajah plough ... 5
	2	Green manuring with san	Ditto	4,840	Ditto	Ditto	0	16	0	27	Country plough ... 1
	3	Green manuring with san and gypsum 1 ton per acre ..	Ditto	4,840	Ditto	28th April 1920 ...	2	3	3	23	Sohaga ... 3
	4	Green manuring with san	Ditto	4,840	Ditto	Ditto	1	4	1	27	Watering ... 18
	5	Green manuring with san and gypsum ½ ton per acre ...	Ditto	3,630	Ditto	Failed					Sowing of green manuring crop— 1st time ... 7th July 1919. 2nd time ... 29th August 1919.
70 Line E	1	Green manuring with guara and gypsum 2 tons per acre	Wheat No. 11	4,840	18th November 1919	28th April 1920 ...	1	16	2	17	Rajah plough ... 5
	2	Green manuring with guara	Ditto	4,840	Ditto	Ditto	0	6	0	10	Country plough ... 1
	(a) 3	Ditto ditto	Ditto	4,840	Ditto	Ditto	0	11	0	20	Sohaga ... 5
	4	Ditto ditto	Ditto	4,840	Ditto	Ditto	0	5	0	9	Watering ... 12
	5	Green manuring with guara and gypsum ½ ton per acre	Ditto	4,840	Ditto	Ditto	0	36	1	23	Sowing of green manuring crop— 1st time ... 14th June 1919. 2nd time ... 3rd September 1919.
88 Line B	1	Guara green manuring	Wheat No. 11	4,840	12th November 1919	Failed					Machine ... 5
	2	Guara green manuring and gypsum 1 ton per acre ...	Ditto	4,840	Ditto	29th April 1920 ...	0	16	0	27	Country plough ... 3
	3	Guara green manuring	Ditto	4,840	Ditto	Ditto	0	2	0	4	Sohaga ... 5
	4	Guara green manuring and gypsum 2 tons per acre ...	Ditto	4,840	Ditto	Ditto	1	5	1	37	Watering ... 14
	5	Guara green manuring	Ditto	4,840	Ditto	Ditto	0	2	0	2	Sowing of green manuring crop— 1st time ... 26th June 1919. 2nd time ... 5th September 1919.
88 Line D	1	Green manuring with san	Wheat No. 11	4,840	12th November 1919	29th April 1920 ...	0	3	0	5	Machine ... 5
	(b) 2	Ditto ditto	Ditto	4,840	Ditto	Ditto	0	10	0	17	Country plough ... 2
	3	Ditto ditto	Ditto	4,840	Ditto	Ditto	0	3	0	6	Sohaga ... 4
	4	Green manuring with san and gypsum 2 tons per acre...	Ditto	4,840	Ditto	Ditto	1	13	2	12	Watering ... 13
	5	Green manuring	Ditto	4,840	Ditto	Failed					Sowing of green manuring crop— 1st time ... 2nd July 1919 2nd time ... 5th September 1919.

(a) Green manure crop was a total failure.

89 Line E	1	Machined and 10 cwt. gypsum per acre applied in 1918	Wheat No. 11	4,840	30th November 1919	20th April 1920 ...	3	4	5	12	¼ line was green manured by carting guara from outside The crop did not rot as was ploughed in late. There was no crop here except few plants.	Machine ... 2 (Plots R. plough) ... 2 & 4 C. plough ... 3 Sohaga ... 2 Watering ... 8
	2	Rajah plough and 5 cwt. gypsum per acre applied in 1918.	Ditto	4,840	Ditto	Ditto	1	33	3	4		
	3	Machined and 5 cwt. gypsum per acre applied in 1918...	Ditto	4,840	Ditto	29th April 1920 ...	0	20	0	34		
	4	Rajah plough	Ditto	4,840	Ditto	Ditto	0	20	0	34		
	5	Machined	Ditto	4,840	Ditto	Failed						
73 Line B	1	Machined	Wheat No. 11	4,840	28th November 1919	25th April 1920 ...	3	30	7	17	There were sandy patches in these plots hence better yield.	Machine ... 1 C. plough ... 2 Sohaga ... 3 Watering ... 5
	2	Ditto	Ditto	4,840	Ditto	Ditto	2	36	4	38		
	3	Machined and 10 cwt. gypsum per acre applied in 1918	Ditto	4,840	Ditto	Ditto	2	5	3	25		
	4	Ditto ditto ditto	Ditto	4,840	Ditto	Ditto	0	38	1	24		
	5	Machined	Ditto	4,840	Ditto	Ditto	0	5	0	10		
73 Line C	1	Machined and 10 cwt. gypsum per acre applied in 1918	Wheat No. 11	4,840	29th November 1919	26th April 1920 ...	1	14	2	12	¼ line was green manured by carting guara from outside. The crop did not rot as was ploughed in late. There was no crop here except few plants.	Machine ... 1 (Plots R. plough) .. 2 & 4 C. plough ... 3 Sohaga ... 3 Watering ... 4
	2	Rajah plough and 5 cwt. gypsum per acre applied in 1918.	Ditto	4,840	Ditto	Ditto	0	19	0	33		
	3	Machined and 5 cwt. gypsum per acre applied in 1918	Ditto	4,840	Ditto	Ditto	0	19	0	33		
	4	Rajah plough	Ditto	4,840	Ditto	Ditto	0	1	0	2		
	5	Machined.	Ditto	4,840	Ditto	Ditto	0	14	0	23		
73 Line E	1	Machined	Wheat No. 11	4,840	28th November 1919	27th April 1920 ..	5	31	9	19	Some good piece of land with few sandy patches.	Machine ... 2 C. plough ... 2 Sohaga ... 3 Watering ... 6
	2	Do.	Ditto	4,840	Ditto	Ditto	2	2	3	20		
	3	Do.	Ditto	4,840	Ditto	Ditto	1	1	1	30		
	4	Do.	Ditto	4,840	Ditto	Ditto	5	12	9	29		
	5	Do.	Ditto	4,840	Ditto	Ditto	0	15	0	26	Good piece of land.	
72 Line A	1	Sand 3" and machined	Wheat No. 11	4,840	13th November 1919	27th April 1920 ..	2	5	3	26	There was no visible effect of sand. Better yield due to sandy patches.	Machine ... 1 C. plough ... 2 Sohaga ... Watering ... 5
	2	Sand 2" and do.	Ditto	4,840	Ditto	Ditto	2	29	4	27		
	3	Sand 1" and do.	Ditto	4,840	Ditto	Ditto	0	35	1	20		
	4	Machined	Ditto	4,840	Ditto	Ditto	0	27	1	6		
	5	Do.	Ditto	4,840	Ditto	Ditto	0	15	6	26		
78 A and B.	...	Guara green manure	Wheat No. 11	9,750	24th November 1920	20th April 1920 ...	9	25	6	20	The green manure crop was a fair one.	

(a) This plot was divided into 5 parts and treated as below :—
(1 and 5) 275 lbs. gypsum per acre.
(3) 200 lbs. sulphuric acid per acre.
(2 and 4) Untreated.

(b) This plot was divided into 5 parts and treated as below :—
(1 and 5) 554 lbs. gypsum per acre.
(3) 400 lbs. of sulphuric acid per acre.
(2 and 4) Untreated.

Green Manuring Experiments.

Experiments have been conducted this year on the same lines and on the same plots as were used previously. A full description of the objects of the experiment was given in last year's report. It is only necessary to mention here that the main object has been to investigate the separate effects of a green manuring crop as a nitrogenous manure and as improving the texture and moisture retaining powers of a soil. This has been done by adding to some of the plots quantities of nitrogen equivalent to those developed by the green manure.

The season, as is well known, has been a remarkably good one for wheat. It is to be expected, therefore, that the results will not show such differences as would be obtained in a less favourable year. In Statement I is shown details of the agricultural operations conducted on the plots. At an early stage of the development of the crop it was obvious that in the manured plots the growth was so luxuriant that it would be impossible to harvest the crop. It was consequently decided to prune the crop in the main area, and as a control a fraction of the area was cut down to the ground.

The weights of the material, green and dry, are shown in Statement II. From this it will be seen that the amount of growth in the sandy plots is increased roughly in the ratio of 3, 10 to 13 by the corresponding applications of 1-to 3 quantities of green manure. In the stiff plots, however, the yields are more uniform, and roughly about three times the yields obtained in the control plots. Despite the pruning, the crop lodged very badly in the more heavily manured plots, and the differences are consequently not as great as would have been obtained if this had not taken place. This is to some extent due to the attack of white ant, which is estimated to be 10—15 per cent. It was more severe in the heavily manured plots than is those receiving a lighter dose.

Statement III shows the yields obtained with remarks as to the state of the crops. Statement IV shows corresponding results obtained from the 15 feet plots where a comparison with the artificial equivalent amounts of nitrogenous manure was conducted. The results are displayed graphically in diagram I together with the results obtained last year. It will be seen that on the big plots the reaction of the green manure has been remarkably smaller, showing very clearly the fact that the maximum return is obtained only on the sandy soil. It is not possible, at present, to give any reliable figures as to the economics by this method of manuring ; in fact the experiments were not designed to investigate this side of the question. Information on this point, however, will become available when the results of experiments being conducted in barani tracts become available. Moreover, complete estimates of the beneficial effect of green manuring cannot be formed until the residual effect of the manure has been taken into account. These plots will now be left untreated and wheat grown as before in order to obtain figures on this point.

Diagram II displays results obtained with equivalent artificial nitrogenous manure. It will be seen that the return bears no comparison with that obtained by green manuring. The actual depressing effect which was observed last year in the stiff plots is repeated this year. It is rather remarkable that this depressing effect has not occurred with the sandy soil as was found last year. It should be noted, however, that in sandy soil while with increasing application of green manure, the yield increases, in the case of artificial manure the yield decreases.

Statements V, VI and VII show the fluctuations of total and available nitrogen in these plots. The plots were sampled for total nitrogen on 3 dates, *viz.*, before burying in the green manure, before sowing, and after cutting wheat. It is remarkable that although an addition of green manure which is roughly equivalent to 40 lbs. of nitrogen per acre for a unit crop of green manure has been made representing an increase in total nitrogen of about 5 per cent, the total nitrogen has in all cases diminished. This is probably due to the fact that as nitrification proceeds the soluble salts are carried with drainage water to lower strata in the soils, and is supported by the fact that this loss is greater in the sandy soils where drainage takes place more readily, as shown in Statement VIII.

Statement VII shows the available nitrogen at different dates immediately before the additions were made to bring up the nitrogen content of the soil to the same point as that of the plot treated with guara, and it will be seen that in no case is the artificially treated plot worse off for nitrogen than the guara plots. It will, therefore, appear that we are justified in assuming that the treatment has rendered both plots comparable as regards their nitrogen contents and that the differences of yield obtained must be due to some other factor.

Statement IX gives details of the amounts of nitrogenous manure and the dates on which they were applied to the artificial plots.

Statement X shows the moisture contents in the first and second nine inches of the soil of the experimental plots at a period of about 16 days after the last irrigation, during which time 0·30 inch rain fell. This rain fell a day after the previous irrigation. It will be noticed that there are no remarkable differences in the variously treated plots. This may, at first sight, be taken to indicate that the treatments adopted have not affected the moisture retaining power of the soil, but when it is remembered that the crops borne by, for instance, the guara plots are as much as 3,10 and 13 times that of the control, it must be admitted that although transpiration of water equivalent to the yield of green matter must have taken place, yet this has not made any differences in the moisture contents of the surface soils. While the above argument cannot be held to prove conclusively that the increase in the moisture holding power brought about by addition of green manure is the sole factor responsible for the increased yields, yet it seems the only one which can possibly account for the enormous differences in growth observed.

EXPLANATION.—The full shaded columns are proportional to percentage increases in grain and straw above the control plots; the striped areas being proportional to excess increase in yield of straw. Red refers to the results of the season 1918-19 and black 1919-20.

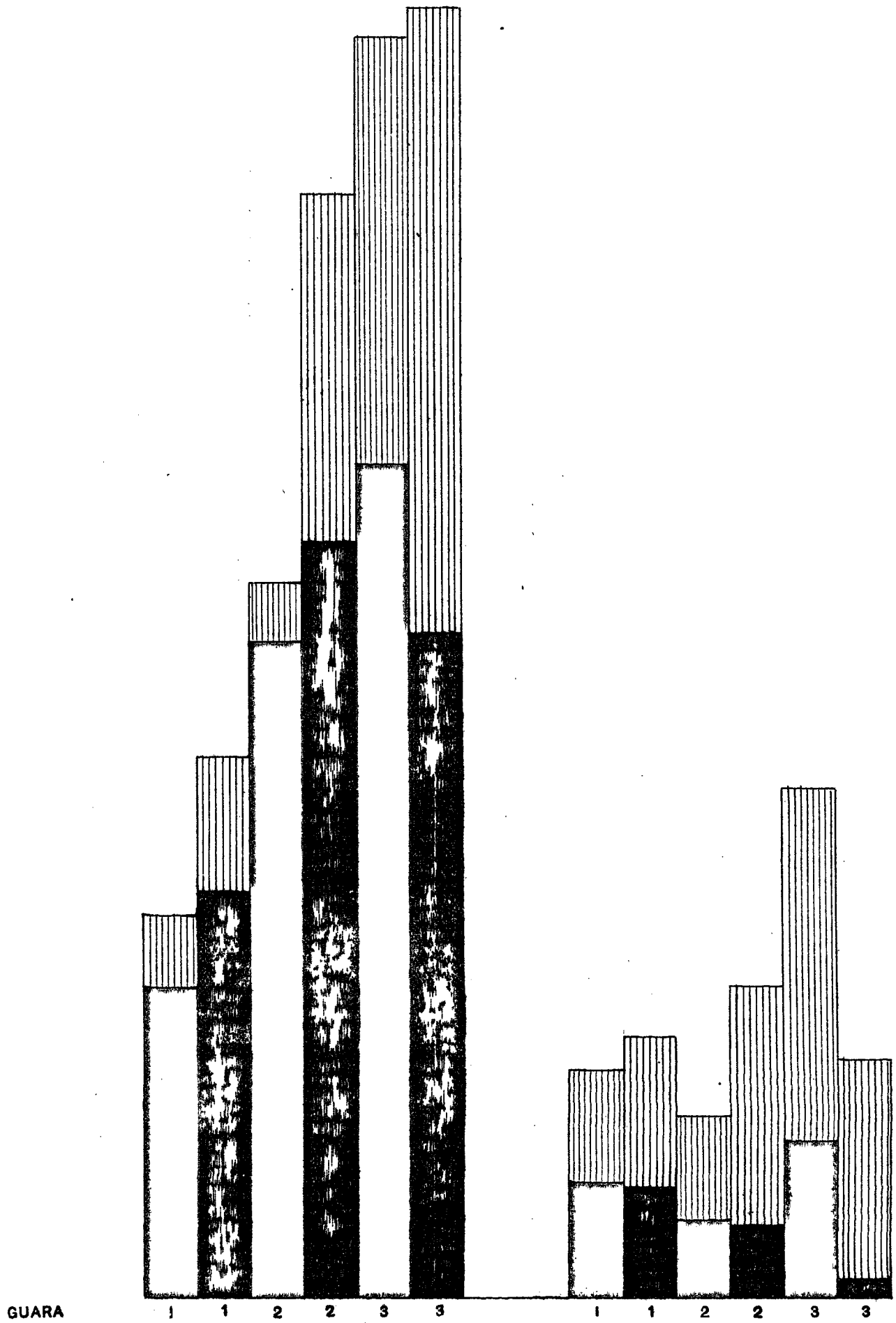


DIAGRAM NO. I.

Photo. Zinco., October, 1920.—No.1582-3.500.

EXPLANATION.—Full shaded columns are proportional to percentage increases in grain and straw above the control plots; the striped areas representing excess increase in straw and the granulated, representing grain. Columns below the line represent decreases. Red refers to the results of the season 1918-19 and black 1919-20.

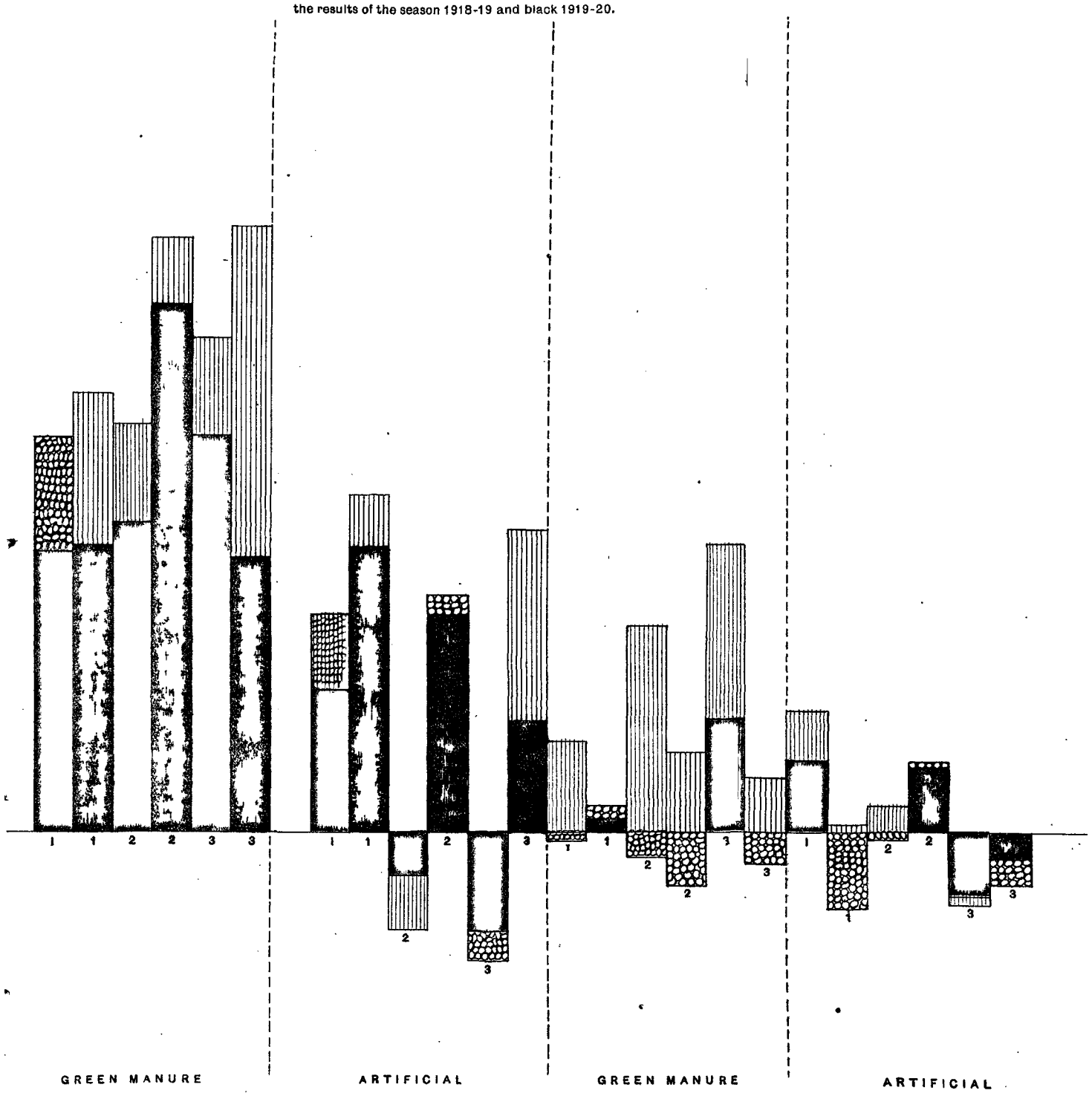


DIAGRAM NO. II.

Photo. Zinco., October, 1920.—No.1582-2.500.

Statement No. I.

GREEN MANURING EXPERIMENTS, 1919-20.

Details of agricultural operations done on th Green Manuring Experiments plots, 1919-20. The operations done and the dates are the same for both the stiff and the sandy soils.

Agricultural operations.	Dates.	Total.
Burying in of guara	2nd September 1919 and 3rd September 1919.	
Ploughings	Controls only, 14th September 1919 and 16th September 1919; all the plots, 25th October 1919 and 9th November 1919 ...	Controls ... ... 4 Guara plots ... 2
Harrowings	Controls, 3rd September 1919, 30th September 1919 (on all Bar Harrow), 18th November 1919, 31st December 1919 (on all Bar Harrow).	Controls ... ... 4 Guara plots ... 2
Schagaings	1st November 1919, 6th November 1919 and 9th November 1919	3
Sowing	16th November 1919, sandy, 17th November 1919, stiff	Once only.
Irrigations	3rd November 1919, 25th December 1919, 11th February 1920 and 3rd April 1920	4
Prunings	5th February 1920	Once only.
Harvesting	29th April 1920, sandy, 2nd May 1920, stiff.	

Statement No. II.

GREEN MANURING EXPERIMENTS, 1919-20.

Weights of the material green and dry.

No.	Plot.	Wheat cut from near the bottom—5th February 1920				Wheat prunings.				Prunings from one acre (calculated).				Ratio as compared with the control.
		Area.	Weight of green wheat.		Weight of dry wheat—24th February 1920.		Area.	Weight of green wheat.		Weight of dry wheat.		Weight of green crop.		Weight of dry crop.		
	Sandy.		Srs.	Chts.	Srs.	Chts		Mds.	Srs.	Srs.	Chts.	Mds.	Srs.	Mds.	Srs.	
1	Guara 1 crop	215 square feet	11	12	1	14	3,655 square feet	0	19	3	½	5	26	0	36	3·19 : 2·73
2	Guara 2 crop	Ditto	36	8	5	11	Ditto	2	13	14	8	27	29	4	13	9·90 : 8·30
3	Guara 3 crop	Ditto	47	0	7	1	Ditto	3	31	22	11	45	0	6	30	12·75 : 10·30
4	Control average of three plots	Ditto	3	11	0	11	...	...		...		...		...		...
	Stiff.															
1	Guara 1 crop	210 square feet	42	10	6	6	1,575 square feet	1	10	7	8	34	23	5	8	3·31 : 2·76
2	Guara 2 crop	Ditto	41	12	6	0	Ditto	1	15	7	15	38	1	5	19	3·24 : 2·59
3	Guara 3 crop	Ditto	51	0	7	2	Ditto	1	24	8	15	44	10	6	7	3·96 : 3·08
4	Control average of three plots	Ditto	12	14½	2	5	...	...		...		...		...		...

Statement No. III.

GREEN MANURING EXPERIMENTS, 1919-20.

Yields, etc., Big plots.

No.	Plot.	Weight of green manure put in.	Dry matter organic.	Yield. Grain.	Yield. Straw.	Calculated amount of green manure in one acre.	Dry matter organic.	Yield per acre. Grain.	Yield per acre. Straw.	Proportion of grain to straw.	Per cent. increase on control. Grain.	Per cent. increase on control. Straw.
	Sandy—$\frac{1}{10}$th acre plot.	Mds.	Mds.	Mds. s. c.	Mds. s.	Mds.	Mds.	Mds. s.	Mds. s.			
1	Guara 1 crop	24	4·32	2 0 2	4 9	240	43·2	20 1	42 10	1 : 2·11	76·44	101·2
2	,, 2 ,, ...	48	8·64	2 30 0	6 18	480	86·4	27 20	64 20	1 : 2·35	142·30	207·2
3	,, 3 ,, ...	72	12·96	2 21 8	7 7	720	129·6	25 15	71 30	1 : 2·83	123·60	241·7
4	Control average of 3 plots	...	...	1 5 7	2 4	...	...	11 14	21 0	1 : 1·85	...	...
	Stiff —$\frac{1}{10}$th acre plot.											
5	Guara 1 crop	12	2·16	1 27 4	3 29	240	43·2	33 25	74 20	1 : 2·21	19·93	47·5
6	,, 2 ,, ...	24	4·32	1 23 2	4 0	480	86·4	31 23	80 0	1 : 2·53	12·67	58·4
7	,, 3 ,, ...	36	6·48	1 17 8	3 25	720	129·6	28 30	72 20	1 : 2·52	2·59	43·6
8	Control average of 3 plots	...	...	1 16 1	2 21	...	...	28 1	50 20	1 : 1·80	...	...

Statement No. IV.

GREEN MANURING EXPERIMENTS, 1919-20.

Yields, etc., 15 feet plots.

No.	Plot.	Weight of green manures put in.	Dry matter organic or artificial manure.	Yield. Grain.	Yield. Straw.	Calculated amount of green manure in one acre.	Dry matter organic or artificial manure.	Yield per acre. Grain.	Yield per acre. Straw.	Proportion of grain to straw.	Per cent increase on control. Grain.	Per cent increase on control. Straw.
	Sandy.	Mds. s.		s. c.	s. c.	Mds.		Mds. s.	Mds. s.			
1	Guara 1 crop	1 10	9 seers	6 6	11 6	240	43 maunds	30 34	55 2	1 : 1·78	72·34	110·5
2	Artificial 1	...	Na No_3 = 720 grams, Am So_4 = 1,458 ,,	6 5½	10 0	...	Na No_3 = 308 lbs. ..., Am So_4 = 624 ,, ...	30 29	48 16	1 : 1·57	71·64	85·1
3	Guara 2 crop	2 20	18 seers	8 9½	13 8½	480	86 maunds	41 25	65 19	1 : 1·57	132·5	150·4
4	Artificial 2	...	Na No_3 = 1,295 grams, Am So_4 = 1,373 ,,	5 14	8 5	...	Na No_3 = 554 lbs. ..., Am So_4 = 587 ,, ...	28 17½	40 9	1 : 1·41	58·8	53·8
5	Guara 3 crop	3 30	27 seers	6 4	13 11	720	129 maunds	30 10	66 12	1 : 2·19	69·0	153·5
6	Artificial 3	...	Na No_3 = 790 grams, Am So_4 = 1,612 ,,	4 12	9 8	...	Na No_3 = 338 lbs., Am So_4 = 690 ,, ...	23 0	45 39	1 : 2·00	28·40	75·8
7	Control average of 3 plots	...	...	3 11	5 6½	...	...	17 26	26 6	1 : 1·46	...	...
	Stiff.											
1	Guara 1 crop	1 10	9 seers	8 6½	13 3	240	43 maunds	40 26	63 35	1 : 1·57	6·33	3·02
2	Artificial 1	...	Na No_3 = 2,326 grams, Am So_4 = 329 ,,	6 6½	13 3	...	Na No_3 = 995 lbs. ..., Am So_4 = 141 ,, ...	30 39½	62 37	1 : 2·03	—18·99	1·45
3	Guara 2 crop	2 20	18 seers	6 14	15 6	480	86 maunds	33 11	74 16	1 : 2·24	—12·98	20·00
4	Artificial 2	...	Na No_3 = 1,087 grams, Am So_4 = 724 ,,	9 5	14 14	...	Na No_3 = 464 lbs. ..., Am So_4 = 310 ,, ...	45 3	71 39	1 : 1·60	17·86	16·09
5	Guara 3 crop	3 30	27 seers	7 4½	14 9	720	129 maunds	35 13	70 18	1 : 1·99	— 7·60	13·63
6	Artificial 3	...	Na No_3 = 2,691 grams, Am So_4 = 745 ,,	6 14½	12 0	...	Na No_3 = 1,151 lbs. ..., Am So_4 = 319 ,, ...	33 16	58 3	1 : 1·74	—12·65	—6·33
7	Control average of 3 plots	...	...	7 14½	12 13	...	...	38 9	62 0	1 : 1·62	...	...

Statement No. V.

GREEN MANURING EXPERIMENTS, 1919-20.

Total Nitrogen Big plots.

No.	Plot.	Before burying Guara—2nd September 1919.	Before sowing wheat—12th November 1919.	After cutting wheat—12th May 1920.	Remarks.
	Sandy.				
1	Guara 1 crop	0·029	0·018	0·0181	
2	„ 2 „	0·031	0·023	0·0215	
3	„ 3 „	0·034	0·019	0·0247	
4	Control	0·010	0·0183	0·0181	
	Stiff.				
5	Guara 1 crop	0·065	0·032	0·0425	
6	„ 2 „	0·052	0·050	0·0391	
7	„ 3 „	0·059	0·055	0·0374	
8	Control	0·061	0·016	0·0340	

Statement No. VI.

GREEN MANURING EXPERIMENTS, 1919-20.

Total Nitrogen 15 feet plots.

No.	Plot.	Total Nitrogen before burning Guara—2nd September 1919.	Total Nitrogen before sowing wheat—16th November 1919 and 17th November 1919.	Total Nitrogen after cutting wheat—29th April 1920 and 2nd May 1920.	Remarks.
	Sandy.				
1	Guara 1 crop	0·028	0·020	0·0167	
2	Artificial No. 1	0·028	0·019	0·0172	
3	Guara 2 crop	0·028	0·023	0·0204	
4	Artificial No. 2	0·028	0·019	0·0174	
5	Guara 3 crop	0·028	0·020	0·0194	
6	Artificial No. 3	0·028	0·019	0·0160	
7	Control	0·028	0·017	0·0160	
	Stiff.				
8	Guara 1 crop	0·066	0·051	0·0410	
9	Artificial No. 1	0·066	0·052	0·0397	
10	Guara 2 crop	0·066	0·060	0·0482	
11	Artificial No 2	0·066	0·061	0·0487	
12	Guara 3 crop	0·066	0·063	0·0506	
13	Artificial No. 3	0·066	0·056	0·0420	
14	Control	0·066	0·048	0·0394	

Statement No. VII.

GREEN MANURING EXPERIMENTS, 1919-20.

Available Nitrogen 15 feet plots.

No.	Plot.	Available Nitrogen—23rd September 1919.			Available Nitrogen— 8th October 1919.			Available Nitrogen on 27th October 1919.		
		Nitrates.	Nitrites	Ammonia.	Nitrates.	Nitrites.	Ammonia.	Nitrates.	Nitrites.	Ammonia.
	Sandy.			Per cent.	on soil.					
1	Guara 1 crop	0·00096	0·000044	0·00290	0·0024	0·000044	0·0020	0·00300	0·000020	0·00064
2	Artificial No. I	0·00036	0·000011	0·00015	0·0015	0·000024	0·0021	0·00296	0·000058	0·00305
3	Guara 2 crop	0·00200	0·000058	0·00200	0·0018	0·000680	0·0025	0·00268	0·000032	0·00191
4	Artificial No. II	0·00036	0·000011	0·00015	0·0026	0·000032	0·0016	0·00292	0·000032	0·00155
5	Guara 3 crop	0·00180	0·000058	0·00280	0·0023	0·000036	0·0026	0·00352	0·000064	0·00301
6	Artificial No III	0·00036	0·000011	0·00015	0·0041	0·000023	0·0023	0·00340	0·000064	0·00221
7	Control	0·00036	0·000011	0·00015	0·0056	0·000016	0·00037	0·00552	0·000012	0·000045
	Stiff.									
8	Guara 1 crop	0·0049	0·000051	0·00079	0·0070	0·000052	0·00086	0·0042	0·000032	0·00039
9	Artificial No. I	0·0016	0·000022	0·00017	0·0046	0·000044	0·00091	0·0131	0·000080	0·00035
10	Guara 2 crop	0·0042	0·000036	0·00120	0·0053	0·000088	0·00210	0·0044	0·000052	0·00149
11	Artificial No. II	0·0016	0·000022	0·00017	0·0064	0·000080	0·00100	0·0044	0·000088	0·00074
12	Guara 3 crop	0·0040	0·000076	0·00150	0·0080	0·000056	0·00100	0·0034	0·000064	0·00149
13	Artifcial No. III	0·0016	0·000022	0·00017	0·0040	0·000056	0·00110	0·0160	0·000104	0·00128
14	Control	0·0016	0·000022	0·00017	0·0012	0·000052	0·00035	0·0032	0·000032	0·000023

Statement No. VIII.

GREEN MANURING EXPERIMENTS, 1919-20.

Estimation of Nitrates in 6 feet plots which had received 10 times the dose of artificial manures.

Plot.	Nitrogen per cent in soil.
Sandy.	
Artificial 1, 1st 9 in	0·0440
„ 1, 2nd „	0·0019
„ 1, 3rd „	0·0010
„ 1, 4th „	0·0034
„ 2, 1st „	0·1000
„ 2, 2nd „	0·0060
„ 2, 3rd „	0·0017
„ 2, 4th „	0·0004
„ 3, 1st „	0·0132
„ 3, 2nd „	0·0200
„ 3, 3rd „	0·0047
„ 3, 4th „	0·0011
Stiff.	
Artificial 1, 1st 9 in	0·0570
„ 1, 2nd „	0·0008
„ 1, 3rd „	0·00048
„ 1, 4th „	*Nil.*

Statement No. IX.

GREEN MANURING EXPERIMENTS, 1919-20.

Artificial manures added from time to time, 15 feet plots.

Serial No.	Plot.	26TH SEPTEMBER 1919.		11TH OCTOBER 1919.		31ST OCTOBER 1919.		REMARKS.
		Sodium Nitrate.	Ammonia Sulphate.	Sodium Nitrate.	Ammonia Sulphate.	Sodium Nitrate.	Ammonia Sulphate.	
	Sandy.	Grm.	Grm.	Grm.	Grm.	Grm.	Grm.	
1	Sodium Nitrate, one quantity ...	333 3	1,458·0	371·9	*Nil*	14·95	*Nil*	
2	Ditto two quantities...	833·1	1,277 0	14·06	0·245	448 4	96·2	
3	Ditto three do. ...	742·3	1,401·0	3 00	0·078	44·84	210·9	448·4 Grm. of Sodium Nitrate have been added to this plot by mistake.
	Stiff.							
4	Sodium Nitrate, one quantitiy ...	1,415·15	320·0	911·5	*Nil*	*Nil*	9·01	
5	Ditto two quantities...	1,084·6	525 6	2·7	0·271	*Nil*	197·6	
6	Ditto three do. ...	1,181·4	690·0	1,510·0	*Nil*	*Nil*	55·28	

Statement No. X.

GREEN MANURING EXPERIMENTS.

Moisture contents just before irrigating the field.

Plot.	10TH JANUARY 1920.	
	1st 9 inches.	2nd 9 inches.
Sandy Big.		
Guara 1 crop	4·18	7·17
„ 2 „	4·19	6·72
„ 3 „	5·87	7·96
Control	5·73	8·11
15 *feet sandy.*		
Guara 1 crop	4·87	7·98
Artificial I	4·58	7·74
Guara II crop	6·76	8·97
Artificial II	5·90	7·94
Guara III crop	5·19	8·25
Artificial III	5·66	8·35
Control	4·76	6·58
Stiff Big.		
Guara 1 crop	11·35	13·46
„ 2 „	13·13	12·01
„ 3 „	12·16	13·78
Control	11·59	12·40

Nitrogen Fixation in Punjab Soils.

This experiment has been conducted on the lines described in last year's report: the object being to obtain statistical evidence of the factors influencing nitrogen fixation. Since the year 1916, when an average fixation amounting to the astounding value of 130 per cent was recorded, nothing approaching this figure has been observed. This year also the fluctuation of total nitrogen content has been negligible, the average fixation amounting to only ×3·5 per cent.

We have therefore to look for some exceptional combination of seasonal influences to account for the 1916 results It may be supposed that during this year conditions obtained similar to those which favour an epidemic in the human race. The results of the recent influenza epidemic have failed to indicate any predisposing causes in the medium of growth or change in the habit of the causal bacteria. It is possible that a similar obscure cause may be at work in the soil. Nevertheless it is of extreme importance to obtain reliable information of the extent and degree of the activities of nitrogen fixing organisms, and it is to be hoped that when a sufficient number and variety of relevent data has been collected, we may be in a clearer position to investigate the causes.

The factors which it was particularly intended to study during the last year are the following:—

1. *The distribution and extent of rainfall.*—No obvious correlation can be supposed to exist on the results of this year's work between this factor and the extent of the nitrogen fixation.

2. *The sterilization of soil.*—The hypothesis underlying the study of this factor is that by a long drought in the summer the upper layer of the soil may become partially sterilized. Under such conditions the protozoal fauna will be destroyed and conditions may be such as to favour a rapid development of nitrogen fixing organisms when the humidity and temperature factors become suitable. The results obtained on the Students Farm, Lyallpur, indicate a slight gain in nitrogen fixation in the sterilized soils amounting to an average of 6·1 per cent compared with—2·6 per cent in the unsterilized soils. The result is outside the limits of experimental error; but no greater reliance can be laid upon it until it has been repeated on many more occasions. The sterilization was conducted by pulverizing the soil to a depth of about a foot.

3. *The effect of cultivation.*—This effect has been studied in all stations where the experiment was conducted. In the case of results appearing in the table as 'normal', ordinary cultivation was conducted after each rainfall. In the case of fields described as 'blank' no operations were conducted beyond the removal of weeds. The average results do not indicate that any very great importance may be attached to this factor, at present, although fields receiving ordinary cultivation show an average loss of 3·3 per cent while uncultivated fields show a gain of 3·8 per cent.

The extent to which the nitrogen reserves in the soil are rendered available during the fallow has been studied only at one station, namely Lyallpur. Figures showing the extent of nitrification are given in Table I below. There is no obvious correlation between the amount of total nitrogen fixed and that nitrified. It is notable, however, that only in one case has there been a decrease, and in all of the others the increase, expressed in lbs. per 9 inch acre is sufficient to supply the average requirements of a wheat crop.

Table I.

Locality.	Nitric Nitrogen. Milligrams in 100 grams of soil.		Increase or decrease per 100 grams of soil.
	May.	October.	
Lyallpur Normal	6·2	9·4	3·2
„ Blank	5·4	7·0	1·6
„ „	6·2	8·6	2·4
„ Normal	7·0	6·2	—0·8
„ Blank	5·4	8·6	3 2
„ Normal	16·6	18·2	1·6

STATEMENT SHOWING THE PERCENTAGE OF NITROGEN FIXED IN DIFFERENT LOCALITIES, 1919.

Statement showing the percentage of Nitrogen fixed in different localities, 1919.

Locality.	Soil.	Treatment given to the soil between May and October 1919.			Total nitrogen present in		Fixation per centage.	Rainfall distribution.					
		Rainfall.	Canal irrigation.	Cultivation.	May.	October.		May.	June.	July.	August.	September.	Total.
		Inches.											
Hissar District—													
Hansi Farm Normal ...	Canal irrigated. Heavy loam ...	7·14	*Nil*	3 ploughings, 2 sohaga ...	45·9	50·3	+ 9·6	·16	·05	4·17	1·92	·84	7·14
„ „ Blank	Ditto ditto ...	7·14	*Nil*	No operation—weeds removed ...	48·4	50·1	+ 3·5						
Jullundur District—													
Village Shakargarh Normal ...	Well irrigated. Heavy loam ...	21·02	*Nil*	5 ploughings	53·9	50·8	— 5·7	·98	...	11·9	6·18	1·96	21·02
„ „ Blank ...	Ditto. ditto ...	21·02	*Nil*	No operations—weeds removed ...	50·4	51·7	+ 2·6						
Shahpur District—													
Sargodha Farm Normal ...	Canal irrigated. Heavy loam ...	7·43	1	3 ploughings, 3 harrowings and 1 hoeing.	45·5	48·2	+ 5·9	...	...	3·03	4·40	...	7·43
„ „ Blank ...	Ditto ditto ...	7·43	*Nil*	No operations—weeds removed ...	35·3	35·7	+ 1·1						
Lyallpur District—													
L. A. S. Normal	Canal irrigated loam	8·18	*Nil*	2 ploughings and 1 hoeing ...	59·8	57·2	— 4·3	...	...	2·86	5·01	·31	8·18
„ Blank	Ditto	8·18	*Nil*	No operation except removal of weeds.	51·6	57·65	+ 11·7						
„ Blank	Ditto	8·18	*Nil*	Ditto ditto	39·2	40·8	+ 4·1						
„ Normal	Ditto	8·18	*Nil*	3 ploughings ... „	41·85	36·65	— 12·4						
„ Blank	Ditto	8·18	*Nil*	No operations except removal of weeds.	37·6	36·0	— 4·2						
„ Normal	Ditto	8·18	*Nil*	4 ploughings and 1 harrowing ...	51·0	47·9	— 6·1						
Students Farm—													
Light unpulverized	Canal irrigated. Light loam ...	8·18	...	No operation	...	...	— 7·2						
„ sterilized	Ditto ditto ...	8·18	...	Soil dug up with kasi ...	...	...	+ 9·7						
Heavy unpulverized... ...	Canal irrigated. Heavy loam ...	8·18	...	No operation	...	...	+ 2·6						
„ sterilized	Ditto ditto ...	8·18	...	Soil dug up with kasi ...	...	...	+ 6·6						
Gujrat District—													
D. B. Farm Normal... ...	Barani sandy	25·73	*Nil*	3 ploughings, 3 sohaga „	35·5	36·7	+ 3·4	...	...	15·68	8·03	2·72	26·43
„ „ Blank	Ditto	25·73	*Nil*	No operations except removal of weeds.	53·5	60·5	+ 13·1						

Sialkot District—																
Choburji Normal	Barani sandy	31·01	*Nil*	3 ploughings, 2 sohaga ...	52·5	54·5	+ 3·2	}	...	·57	18·96	7·99	·52	28·04
„ Blank	Ditto	31·01	*Nil*	No operations except removal of weeds.	52·0	51·7	—0·6	}						
Gujranwala District—																
Arup Normal	Barani loam	22·25	*Nil*	7 ploughings	39·9	39·6	— 0·7	}	1·76	...	8·40	11·14	0·95	22·25
„ Blank	Ditto	22·25	*Nil*	No operations	40·9	38·8	—5·1	}						
Montgomery District—																
Farm Normal	Canal irrigated loam	6·79	*Nil*	5 ploughings	46.6	42·4	—9·0	}	...	...	4·18	1·59	1·02	6·79
„ Blank	Ditto	6·79	*Nil*	No operations except removal of weeds.	54 4	49·7	—8·6	}						
Okara Oat Hay Farm—																
Normal	Canal irrigated loam	8·94	*Nil*	5 ploughings	49·3	50·4	+ 2·2	}	...	...	5·34	3·3	·3	8·94
Blank	Ditto	8·94	*Nil*	No operation except removal of weeds.	49·3	51·1	+ 3·6	}						
Rohtak District—																
Normal	Canal irrigated fine loam ...	16·31	*Nil*	No operations, lot of weeds ...	61·2	62·1	+ 1·5	}	...	...	6·62	9·54	·15	16·31
Blank	Ditto	16·31	*Nil*	Ditto ...	61·4	62·5	+ 1·8	}						
Gurdaspur District—																
Farm Normal	Barni sandy	26·55	*Nil*	3 ploughings, 2 harrowings and 1 hoeing.	57·4	56 7	— 1·2	}	2·06	0·65	14·44	8·74	0·66	26·55
„ Blank	Ditto	26·55	*Nil*	No operations except removal of weeds.	43·6	38·4	— 11·9	}						
„ Normal	Canal irrigated loam	26·55	*Nil*	3 ploughings, 2 harrowings and 2 hoeings.	45·0	42·4	—5·7	}						

+3·5 per cent fixation for the whole province.

Sullage Disposal Experiments.

The work on this subject described in last year's report was confined to an attempt, by intensive cropping, to level up the land which is to be utilized for this experiment. In the rabi of 1919-20, the application of sullage was commenced in various stages of dilution with canal water. The crop has suffered to a considerable extent from lodging especially in the smaller plots and this has undoubtedly tended to make the results of the yields less reliable. There is no obvious correlation, however, between the extent of lodging and the treatment received. In future years it is intended to use a crop which will not suffer from this defect when heavy yields are obtained, and for this purpose it is intended to experiment with sugarcane. The record of the total nitrogen so added has been kept, and the changes of total and available nitrogen in the soil have also been investigated periodically. Four concentrations of sullage were used in addition to the canal water which was used in the control plots. Statements I and II show the yields of wheat obtained, and these yields have been compared with those obtained last season. It will be seen that there is no marked difference in the yields so far, and the land is still far from level. The amounts of the yields in similarly treated plots compared with those obtained last year afford some indication of the results by the treatment of sullage. This is shown in Statement III where it will be seen that the lowest yields have been obtained in all cases in the plots treated with full sullage. The figures are not sufficiently reliable to justify us in forming any opinion of the most effective concentration of sullage, but the results published indicate that a concentration of $\frac{3}{4}$ sullage and $\frac{1}{4}$ canal water gives the best results. It will only be by continuing the treatment of these plots in the same way for several years that we shall be able to confirm this result definitely.

Statement IV gives the results for the fluctuations in nitrogen and these are produced graphically in diagram III. The total nitrogen applied to the plots calculated on an acre work out as follows :—

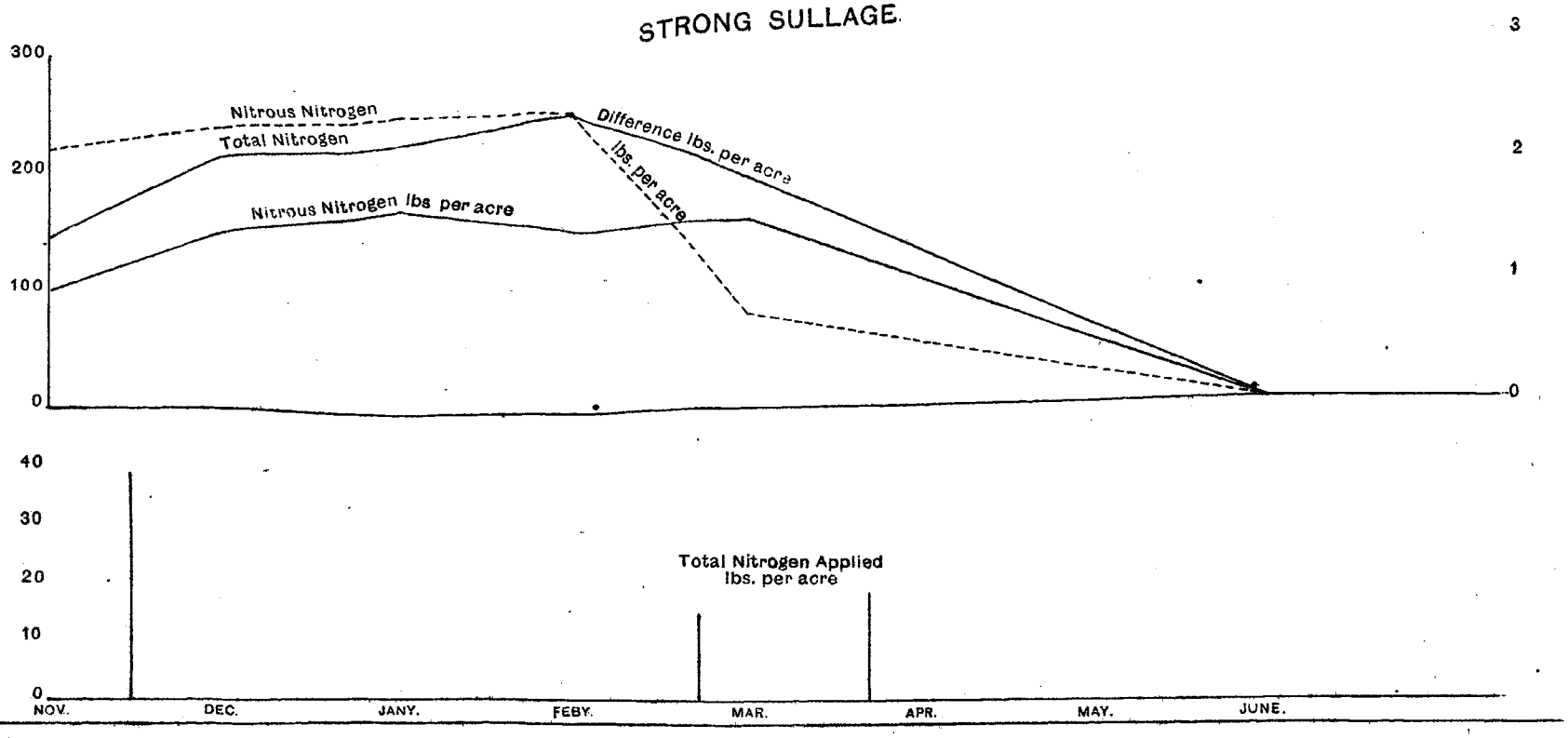
Full sewage	- 74·36 lbs per acre.	
Half sewage	41·65	„ „
$\frac{1}{4}$th „	29·59	„ „
Canal	7·54	„ „

In the same table is given the concentration of total nitrogen in milligrams per hundred grams of the soil. It will be seen that there is no corresponding increase in the total nitrogen in those plots which receive the heaviest application of sullage. The figures for available nitrogen (nitrous and nitric) are however more instructive. It will be seen from the diagram that after the point where a second application of manure was given in February rapid de-nitrification has taken place. It is most marked in the plots receiving full and half sullage. There is no corresponding fall in nitric nitrogen in the plots treated with weaker solutions. It appears probable therefore that the excess of organic matter applied with sullage at this point in the growth of the crop brings about de-nitrification which is probably responsible for the diminished yields. In succeeding experiments it is intended to test the effect of application of sullage previous to sowing the crop with the idea of getting all the organic matter nitrified before hand. This with many other points of interest which are brought out by curves can only be elucidated by further experiments.

Statement I.

No. of plot.	Treatment.	Area in acres.	Yield in seers.			Yield if area were ·05 acre (in seers).			Relative yields.			Remarks.
			Grain and straw.	Grain.	Straw.	Grain and straw.	Grain.	Straw.	Grain and straw.	Grain.	Straw.	
1	Canal irrigation	·05	169	58	111	169	58	111	1·2	1·27	1·18	
2	„ „	·05	210	69	141	210	69	141	1·49	1·52	1·50	
3	„ „	·05	211·5	70·25	141·25	211·5	70·25	141·25	1·5	1·54	1·51	
4	„ „	·05	189	68	121	189	68	121	1·34	1·49	1·29	
5	„ „	·05	186·5	67·5	119	186·5	67·5	119	1·32	1·48	1·27	
6	„ „	·05	141	47·25	93·75	141	47·25	93·75	1·0	1·04	1·0	
7	¼ sewage, ¾ canal	·0425	149	52·5	96·5	175·25	61·75	113·5	1·25	1·35	1·21	
8	„ „	·05	184	63	121	184	63	121	1·3	1·38	1·29	
9	„ „	·05	220	67·75	152·25	220	67·75	152·25	1·56	1·49	1·62	
10	„ „	·05	230	65	165	230	65	165	1·63	1·43	1·76	
11	„ „	·05	217	70·75	146·25	217	70·75	146·25	1·54	1·55	1·56	
12	„ „	·05	165·5	55·25	110·25	165·5	55·25	110·25	1·17	1·21	1.18	
13	¾ sewage, ¼ canal	·0425	160	49·5	110·5	188·2	58·23	130	1·33	1·28	1·39	
14	„ „	·05	210	70	140	210	70	140	1·49	1·54	1·49	
15	„ „	·05	222	69·5	152·5	222	69·5	152·5	1·57	1·53	1·63	
16	„ „	·05	234	68	166	234	68	166	1·66	1·49	1·77	
17	„ „	·05	252	76	176	252	76	176	1·79	1·67	1·88	
18	„ „	·05	217	45·5	171·5	217	45·5	171 5	1·54	1·0	1·83	
19	Sewage only	·05	171	53·75	117 25	171	53·75	117·25	1·21	1·18	1·25	
20	„ „	·05	206	63·25	142·75	206	63·25	142·75	1·46	1·39	1·52	
21	„ „	·05	222	60·5	161·5	222	60·5	161·5	1·57	1·33	1·72	
22	„ „	·05	196	57·5	138·5	196	57·5	138·5	1·39	1·26	1·48	
23	„ „	·05	213	60·75	152·25	213	60·75	152·25	1·51	1·34	1·62	
24	„ „	·05	177	47·5	129·5	177	47·5	129·5	1·26	1·04	1·38	

STRONG SULLAGE.



HALF SULLAGE.

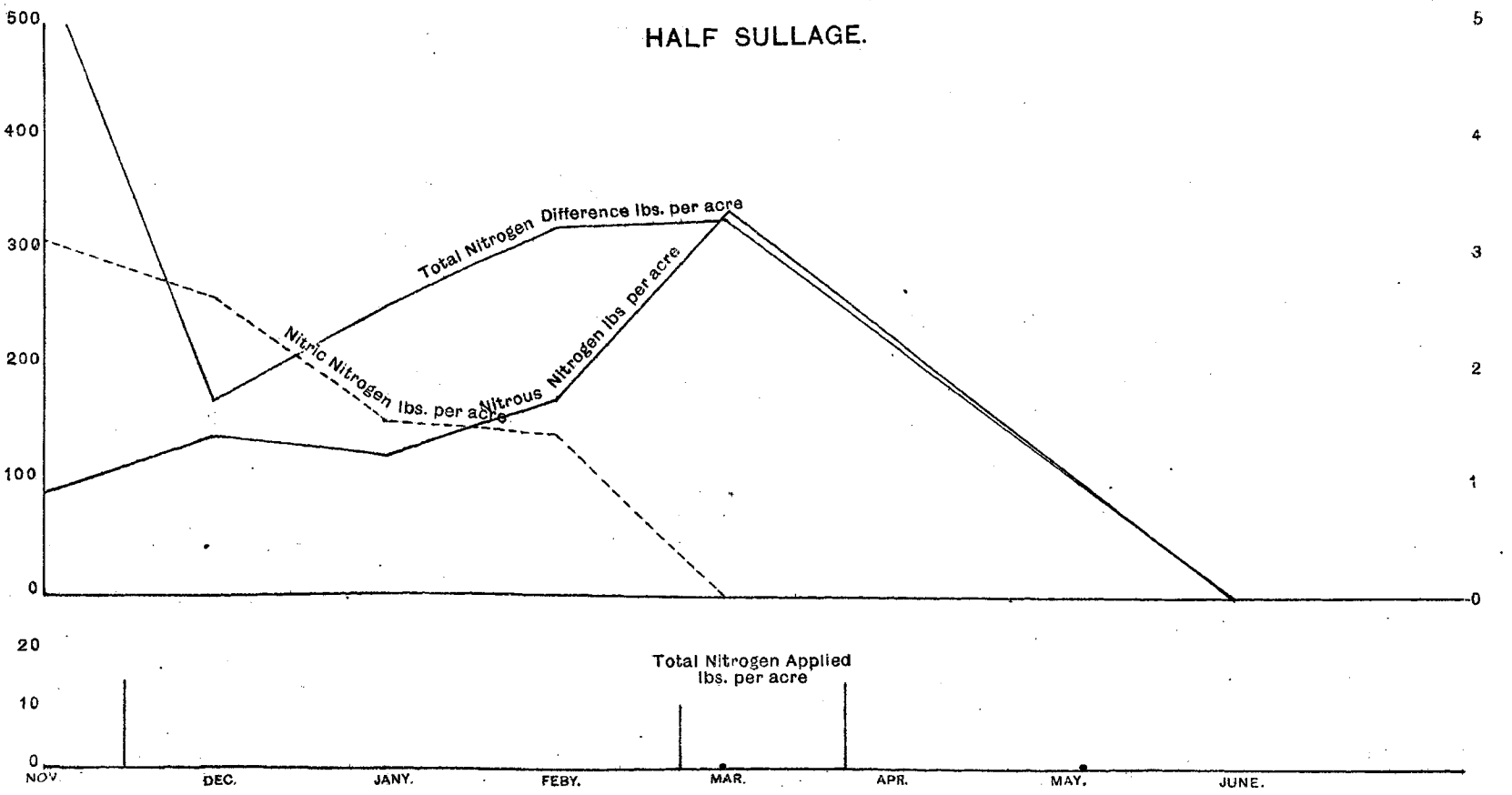
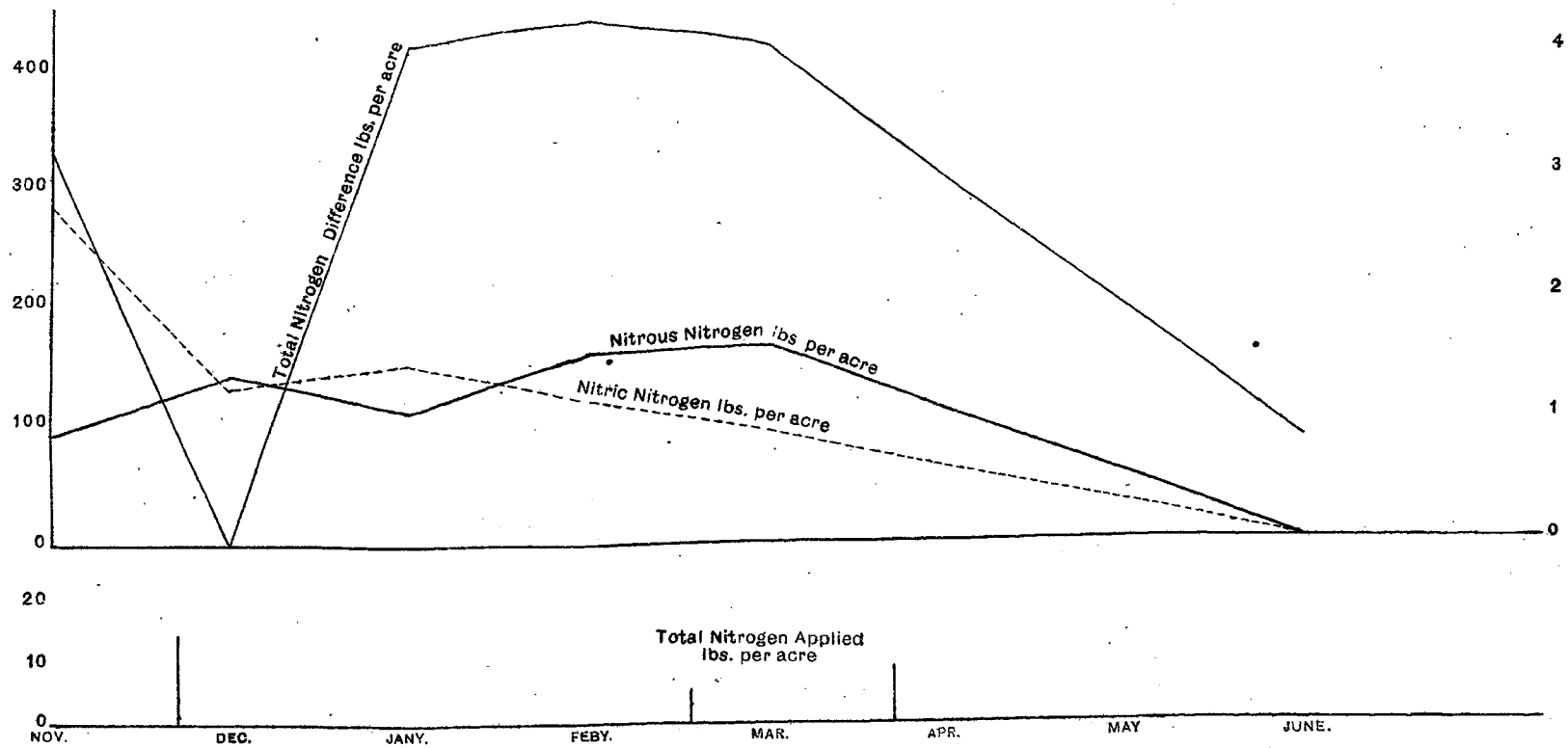


Photo. Zinco., October, 1920.—No. 1582.500.

DIAGRAM III.

25 o/o SULLAGE.



CANAL IRRIGATED.

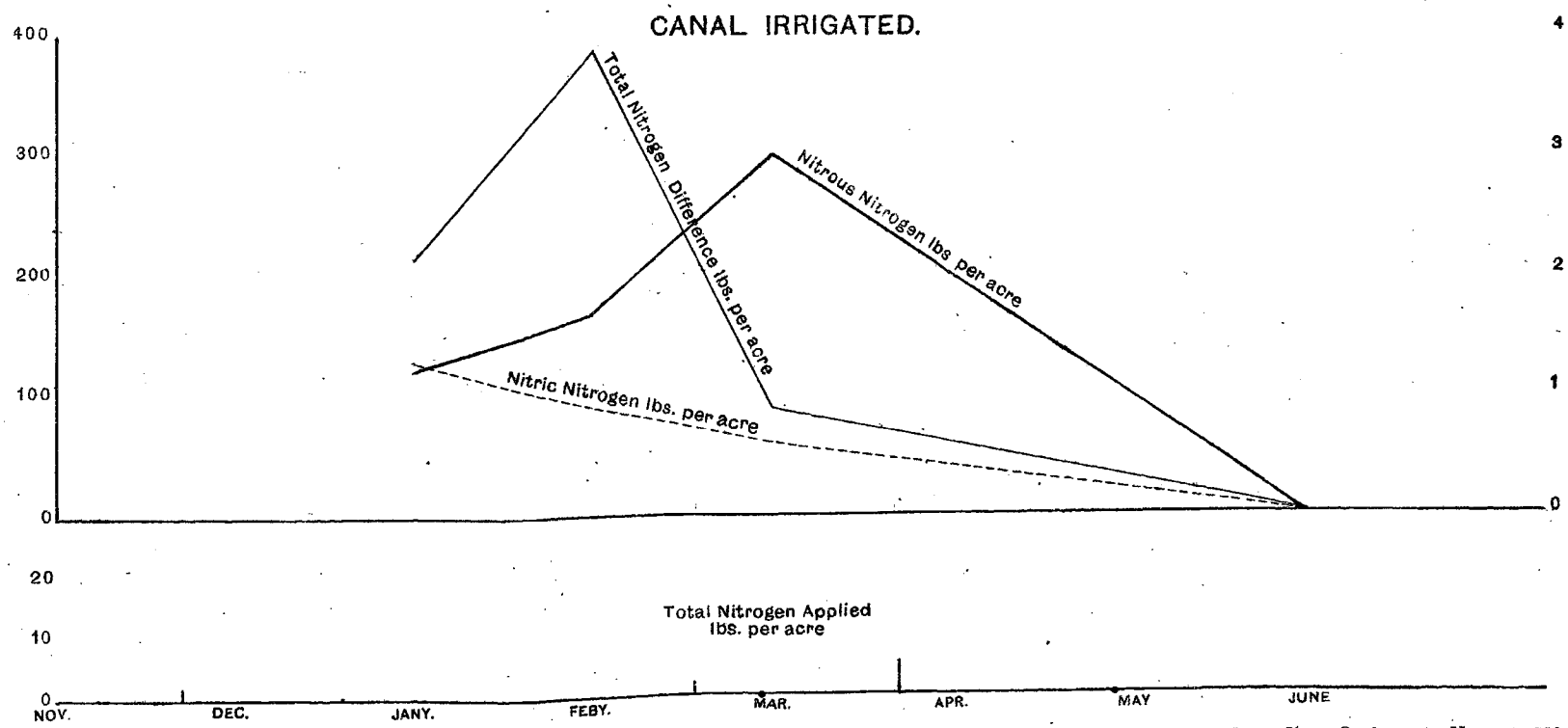


Photo. Zinco., October, 1920.—No. 1582-1.500.

DIAGRAM IV.

Statement II.

COMPARISON OF THIS YEAR'S YIELD WITH LAST YEAR'S PRODUCE.

No. of plot.	Treatment.	Area in acres.	Yield in seers.		Increase or decrease.	Per cent. increase or decrease.	Ratio.	Remarks.
			This year's 1919-20.	Last year's 1918-19.				
1	Canal only	·05	169	61	+ 108	+ 177·1	2·77	
2	„ „	·05	210	53	+ 157	+ 296·2	3·96	
3	„ „	·05	211·5	60	+ 151·5	+ 252·5	3·53	
4	„ „	·05	189	62	+ 127	+ 204·8	3·05	
5	„ „	·05	186·5	80	+ 106·5	+ 133·1	2·33	
6	„ „	·05	141	57	+ 84	+ 147·4	2·47	
7	¼ sewage, ¾ canal	·0425	175·25	60	+ 115·25	+ 192·1	2·92	
8	„ „	·05	184	55	+ 129	+ 234·6	3·35	
9	„ „	·07	229	75	+ 145	+ 193·4	2·93	
10	„ „	·05	230	70	+ 160	+ 228·6	3·29	
11	„ „	·05	217	62	+ 155	+ 250	3·5	
12	„ „	·05	165·5	86	+ 79·5	+ 92·5	1·92	
13	¾ sewage, ¼ canal	·0425	188·2	66	+ 122·2	+ 185·2	2·85	
14	„ „	·05	210	54	+ 156	+ 288·9	3·89	
15	„ „	·05	222	57	+ 165	+ 289·5	3·89	
16	„ „	·05	234	59	+ 175	+ 296·6	3·97	
17	„ „	·05	252	95	+ 157	+ 165·3	2·65	
18	„ „	·05	217	132	+ 85	+ 64·4	1·64	
19	Sewage only	·05	171	65	+ 106	+ 163·1	2·63	
20	„ „	·05	206	56	+ 150	+ 267·9	3·68	
21	„ „	·05	222	89	+ 133	+ 149·5	2·49	
22	„ „	·05	196	94	+ 102	+ 108·5	2·09	
23	„ „	·05	213	124	+ 89	+ 71·8	1·72	
24	„ „	·05	177	188	− 11	− 5·8	0·94	

Statement III.

Treatment.	Yield if area were ·05 acre (in sfers).			Relative yields.			Comparison with last year's crop.		Remarks.
	Grain and straw.	Grain.	Straw.	Grain and straw.	Grain.	Straw.	Ratio.	Per cent increase or decrease.	
Small plots—									
Canal irrigated ...	184·5	63·3	121·16	1·03	1	1·08	3 02	+ 201·95	
¾ canal, ¼ sewage ...	198·62	63·9	134·78	1·09	1·009	— 1·2	2·97	+ 198·53	
½ „ ½ „ ...	220·5	64·5	156·0	1·21	1·019	1·4	3·15	+ 214·98	
Sewage only ...	197·5	57·21	140·29	1·085	0·9	1·24	2·26	+ 125·8	
Big plots—									
Canal irrigated ...	187·63	65·5	122·13	1·03	1·034	1·09	2·205	+ 100·3	
¾ canal, ¼ sewage ...	193·5	75·75	117·75	1·06	1·19	1·05	2·45	+ 145·0	
½ „ ½ „ ...	182·0	69·5	112·5	1	1·09	1	1·65	+ 65·5	
Sewage only. ...	195·25	72·0	126·25	1·09	1·14	1·12	1·43	+ 42 8	

Statement IV.

No. of plot.	Treatment.	Area in acres	Yield in seers.			Yield if area were ·05 acre (in seers).			Relative yields.			Total nitrogen supplied, lbs.
			Grain and straw.	Grain.	Straw.	Grain and straw.	Grain.	Straw.	Grain and straw.	Grain.	Straw.	
25	Sewage only	·15	595	214·75	380 25	198·25	72	126·25	1·4	1·57	1·35	11·1'535
26	Canal only	·15	568	203	365	189·25	67·25	122	1·34	1·49	1·29	1·1'264
27	Half sewage	·15	546	208·5	337·5	182	69·5	112 5	1·29	1·53	1·2	6·247
28	Canal only	·15	558	191·5	366·5	186	63·75	122·25	1 32	1·40	1·3	1·1'264
29	One-fourth sewage	·15	581	227·5	353·5	193·5	75·75	117·75	1·37	1·67	1 26	4·4·385

Statement IV—concluded.

No. of plot.	Treatment.	Area in acres.	Nitrogen contents of the soil, (milligrams per 100 grams of soil).																Comparison with last year's crop.				
			November.			*December.*			*January.*			*February.*			*March.*			*June.*			This year's yield, 1919-20.	Last year's yield, 1918-19.	Increase or decrease.	Per cent. increase or decrease.	Ratio.
			Total N.	Nitrous N.	Nitric N.	Total N.	Nitrous N.	Nitric N.	Total N.	Nitrous N.	Nitric N.	Total N.	Nitrous N.	Nitric N.	Total N.	Nitrous N.	Nitric N.	Total N.	Nitrous N.	Nitric N.					
25	Sewage only ...	·15	47·23	·022	4·4	48·59	·03	4·8	48·99	·036	5·3	49·55	·032	5·3	48·31	·032	1·6	44·3	*Nil*	*Nil*	198 5	139	+59·5	+42·8	1·43
26	Canal only ...	·15	Not done.			Not done.			48 19	·029	3·0	52·68	·034	2·0	41·45	·076	1·2	43·85	*Nil*	*Nil*	189·25	124	+65·25	+52 6	1·53
27	Half sewage ...	·15	52·0	·018	6·2	44·29	·028	5·2	45·74	·024	3·0	47·91	·034	2·8	48·05	·068	*Nil*	41·07	*Nil*	*Nil*	182	110	+72	+65·5	1·65
28	Canal only ...	·15	Not done.			Not done.			50·09	·024	2·2	50·23	·032	1·6	50·02	·044	1·2	43·65	*Nil*	*Nil*	186	75	+111	+148	2·48
29	One-fourth sewage ...	·15	50·98	·018	5·5	44·4	·028	2·6	53·02	·022	3·0	53·22	·032	2·4	52·55	·032	1·8	46·05	*Nil*	*Nil*	193 5	79	+114·5	+145	2·45

Annual Report of the Entomologist to the Government, Punjab, Part II.

(I) General.

Staff.—I was transferred from the Agricultural Research Institute, Pusa, and joined the Agricultural Department of this province on 30th September 1919 as Entomologist to the Government, Punjab; since then I have been in charge of the Entomological Section. I went out of the province to Nagpur (Central Provinces) to attend the Indian Science Congress, where I read two papers before the Zoology Section, and I went to Kashmir for 6 weeks to study the problems connected with Sericulture.

Lala Madan Mo han Lal, Assistant Professor of Entomology, was in charge till the 30th September 1919.

Lala Salig Ram, Demonstrator, left on 5th September 1919, and since then, the post of Demonstrator remained vacant.

Increase in the present staff is urgently needed.

Teaching.—Absence of a Demonstrator necessitated my spending much of my time in teaching Zoology and Entomology. The classes for practical work were too big (about 30 students in each group) and could not be managed by the Assistant Professor alone. Very great changes have been made in the standard and nature of teaching both in Zoology and Entomology, with a view to provide better mental training for the students without sacrificing the practical needs. At present, too, little time is spent on Entomology. If it is desired that the Agricultural Assistants going out of this college should have knowledge of the facts of Entomology, sufficient for them to make them take keen interest and prove useful in guiding and instructing zamindars in checking insect pests, it is highly necessary that they should be given a really good training, so that they understand the essentials of the science and have a thorough grasp of its principles. To attain this object Entomology should be included in the B.Sc. course. Outside India the value of this branch of Zoology is well recognised and in England, which is not an agricultural country, training in advanced Agricultural Entomology is provided for in most of the Universities. It is time that we realised the importance of insects to agriculturists.

Library.—Higher type of research is not possible without a good up-to-date reference library. Thanks to the generous grants of the Director of Agriculture, I have been able to get complete sets of over a dozen more useful publications on Entomology and hope to be able to get a decent library soon. At present we depend chiefly on the Pusa Library, and I have to acknowledge with thanks the loans of books and journals made to us by the Agricultural Advisor, Government of India, and also for giving us a complete set of the Fauna of British India.

Laboratory.—The laboratory is too small for teaching work and inadequate for research both in the matter of space and equipment. When I took over the charge the Entomological Section possessed for the use of 5 members of the staff and about a hundred students, dissecting microscope and 2 compound microscopes, and it is not surprising to find this want of apparatus reflecting on the work done. The teaching must essentially be superficial, and the work done of a low order. We require tens of thousands of rupees to come up to a decent standard. I hope to get a good laboratory in the new extensions and an up-to-date equipment for both research and teaching.

Insectory.—A proper insectory with a big compound is an absolute adjunct to an Entomological Section. No work on life histories and parasite breeding can be done without a proper place; and a thorough knowledge of life histories, habits, &c., is essential for discovering weak points for a successful attack. Some very important and interesting experiments were ruined for want of an Insectory.

Propaganda.—A scientifically conducted propaganda is the soul of Applied Entomology Discoveries, however striking, remedial measure, however successful, are of no avail if they are not advertised to the fullest extent and adapted by the people. In a country where the masses, for whose benefit the agricultural department exists, are illiterate the work of spreading an information is very difficult if not impossible. Outside India propaganda work is carried with great vigour, and enough cannot be done in this direction. So far very little has been done, and very few people actually know of a place or a person to whom they can write for information and advice on insect pests. The Agricultural Assistants in the district, either through lack of training in Entomology, or want of time, or some other reason, are not giving us any help. Very very few enquiries or complaints are addressed to us by Agricultural Assistants. Our own staff is not even sufficient for research and teaching work. If Agricultural Entomology is to be a living and growing branch of Agricultural Department, and if it has to discharge an important duty, we must advertise in season and out, at every fair, gathering, or exhibition and infuse some knowledge of insect pests and their remedies into the minds of men. Last year at the request of Mr. Fatteh Din, Officiating Deputy Director of Agriculture, an exhibition of Entomology and Sericulture was arranged in connection with the Sikh Educational Conference at Dinga (Gujrat), with very hopeful results, thousands of people came to visit our show of sericulture and insect pests and received useful information.

Silk exhibitions were held at Kulu, Gurdaspur and Zafarwal. It is desirable that the work should increase and arrangements are being made for a series of lectures illustrated by lantern slides as one means of advertisement.

(II) Entomological.

We could devote our attention to only a few of the most important pests.

Cottons.—The cotton bollworm—(*Earias insulana*, Boisd, and *Earias fabia*, Stoll.)

The work on the cotton bollworms and their parasites was continued throughout the year. In 1919 cotton remained almost free from the attacks of these insects. The failure of the cotton crop last year lead many cultivators in the colony (Lyallpur and Sargodha) to make complaints against insect attack—*Tela* or *Sundi*, but in almost all cases, which were investigated, the damage from the bollworm was found to be unimportant and below normal.

The following tables would give some idea of the damage done :—

I.—Table showing average attack of bollworm at Lyallpur Farm.

Time.	Total No. of flower buds and bolls examined.		Percentage of Attack.		Remarks.
	Desi.	American.	Desi.	American.	
July 1919	275	53	11·65	2·0	
August 1919	827	...	14·72	...	
November 1919	1,035	1,211	6·20	32·0	Parasites commonly met with.
Ditto	2,920	2,228	4·20	13·95	Ditto.
December 1919	4,089	1,268	4·79	11·95	Ditto.
Ditto	865	620	14·60	18·40	Ditto.
January 1920	718	671	5·71	15·49	Ditto.
June 1920	1,096	2,410	2·44	1·76	

II.—Table showing average attack of bollworm in Lyallpur District.

Time.	Total No. of buds and bolls examined.		Percentage of attack.		Remarks.
	Desi.	American.	Desi.	American.	
July 1919	...	...	16·6	...	
August 1919	220	...	25·0	...	
September 1919	...	...	7·0	4·0	
October 1919	2,103	1,696	3·6	7·4	Sangla.
Ditto	8,158	...	11·5	...	Gojra (mixture of Desi and American).
November 1919	1,078	891	14·05	27·05	Chak 79.
December 1919	...	1,259	...	17·14	Narwala.
Ditto	1,881	112	11·80	12·50	Ghuna.
Ditto	2,907	1,825	9·73	16·50	Chak 79.
Ditto	1,419	1,408	13·70	14·57	Do.
Ditto	635	590	15·70	18·75	Dijkot.
January 1920	2,05	292	9·14	8·90	Do.
	...	437	...	9·27	Chak 29.
June 1920	...	242	...	5·0	Chak 213.
	29	166	0·0	4·81	Chak 204.
	...	109	...	2·46	Do.
	182	396	9·34	1·02	Dijkot.
	326	223	4·63	2·69	Chak 20.
	560	490	·35	1·96	Chak 189.
	435	253	0·0	0·0	Paccimani.

III.—Table showing attack of bollworm in other districts.

Time.	Total No. of buds and bolls examined.		Percentage of attack.		Remarks.
	Desi.	American.	Desi.	American.	
August 1919	160	158	20·0	4·0	Pirowala.
Ditto	...	...	20·0	...	Hansi.
September 1919	852	14,274	5·47	5·3	Ferozepore circle.
October 1919	252	...	6·0	...	Bhatla (Hansi).
Ditto	1,090	3,858	3·7	2·47	Rohtak.
	...	2,092	...	13·65	Bhatinda Division.
	...	2,529	6·85	...	Sargodha (mixture of Desi and American).
November 1919	...	1,105	...	5·5	Pirewala.
	...	1,706	...	7·3	Changa Manga.
	237	1,685	13·8	4·86	Montgomery.
January 1920	...	412	...	4·69	Sargodha.
February 1920	76	...	6·6	...	Rohtak.
April 1920	94	207	13·8	15·4	Hansi.
June 1920	43	30	6·9	5·5	Sargodha.

The parasite *Microbracon sp* was established at the Lyallpur and Hansi farms early in July, and during August and September large number of parasite boxes were distributed by us to the Agricultural Assistants and private zamindars. Large amount of work was done in this connection in Ferozepore and Bhatinda Division. The Executive Engineer of Ferozepore, Mr. Jesson, was pushing the cultivation of American cotton and we worked in collaboration with him in establishing and distributing the parasites. Mr. Jesson had got prepared over a thousand parasite boxes according to the design supplied by us, and these boxes were filled with parasitised material supplied by us and were constantly used during August, September and October. The parasite was found to be established at every place examined.

This was done before my taking over the charge. There is difference of opinion as to the efficacy of parasites in checking cotton bollworm, and since October last, when I joined, more attention has been paid to working out the binomics of the bollworm and its parasites and finding by actual experiments if the parasite is successful. Lala Umrao Bahadur, my Assistant, has been specially put on this work. Our chief difficulties have been the absence of a field insectory and proper cages.

Earias.—Moths were bred out in the laboratory from November onwards and they were made to lay eggs on Holly hock (*Althea rosii*) grown under cages. All our attempts in finding out the actual number of eggs laid by a female moth have so far failed. The dissection of the female moth shows as many as over 300 eggs, ready with shells, and many more immature eggs, but the highest number of eggs that was laid by a female moth caught from the fields in February was 108.

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The total length of the life history from egg to adult depends upon the season. It is much longer in Winter than in Summer. The following examples, taken from many life cycles which have been studied, illustrate this point :—

Table showing length of life cycle of E. insulana *in the labloratory at Lyallpur.*

Serial No.	Date of oviposition.	Date of hatching.	Date of pupation.	Date of emergence of moth.	Total No. of days.
1	16th-17th November	22nd-23rd November	24th January ...	11th-12th March ...	116
2	25th-26th November	3rd-4th December	4th February ...	13th-14th March ...	109
3	9th-10th December...	22nd-23rd December	24th February ...	18th-19th March ...	100
4	17th-18th February...	27th-28th February	28th March ...	19th-20th April ...	62
5	23rd-24th February...	3rd-4th March ...	29th March ...	20th-21st April ...	57
6	25th 26th February ..	2nd-3rd March ...	3rd April ...	20th-21st April ...	55
7	26th-27th February...	6th-7th March ...	10th April ...	21st-22nd April ...	55
8	1st-2nd March ...	5th-6th March ...	2nd April ...	14th-15th April ...	45

Investigations to find out the alternative host plants were taken in hand. Holly hock (*Althea rosii*) appears to be the most favourite food plant of *Earias* in Spring. During February and March more eggs are laid on it than on any other Malvacious plant. Bhindi (*Hibiscus esculentus*) comes next in importance. *Hibiscus rosasinensis* has been found to bear only very few eggs, while no eggs have yet been observed on *Sida cordifolia* in fields, though inside a cage when no other foodplant was provided *Earias* lays its eggs and breeds on it. Some caterpillars have, however, been observed feeding on *Sida cordifolia* in the fields in the end of March.

Parasites of the various stages of *Earias*.

Egg.—In March large collections of eggs of *Earias* were obtained and some chaloid parasites hatched out of them One of these chalcids was liberated in a glass dish with 26 fresh bollworm eggs, 23 of w hich it stung and 13 chalcids came out of them. The life cycle of this parasite was found to be 10 to 15 days. The parasitized eggs turn blackish and can easily be recognised.

Larva.—Five different parasites have been bred out from various collections of *Earias* caterpillars. One Tachinid, one chalcid, and 3 braconids including *microbracon Sp.*

The *tachinid* is an internal parasite, the maggot feeding inside the host, when full fed it eats its way out and pupates. Bollworm is attacked by this parasite during April and May (on Holly hock) and November and December (on cotton). In April and May the period of pupation is 7 to 9 days, but in Winter (November to January) it takes 3-4 weeks.

This fly is quite common.

Chalcid.—This parasite is small and pupates openly, unlike *microbracon* that pupates in a silken cocoon. During December and January this parasite takes about 2 months to complete its life cycle. It has been observed from April to June and in November and December.

Braconid.—Except *Microbracon* other braconids are very rare. *Microbracon* was captured from the fields from November to January at Lyallpur, but since then it has not appeared at Lyallpur. Attempts made to get eggs in the laboratory were unsuccessful in last Winter, but this Summer we have been successful in getting eggs, under experimental conditions. The work is progressing satisfactorily and a paper on the Oviposition of *Microbracon* will be read at the next Entomological meeting.

At Rohtak specimens have been obtained in October.

Cocoons.—Different specimens of chalcid and braconids have been obtained from cocoons.

We are endeavouring to get definite figures as regards the number of bollworm present and number parasitized. The figures are available only for a part of the year.

Some other insects have been found doing damage to cotton, the more important of them are :—

1. *Platyedra gossypiella*.—The pink bollworm of cotton is a bad pest in Egypt and also in the United Provinces, but is still a minor pest in the Punjab. Caterpillars were found in green bolls at Hansi and Rohtak. During December and January a large collection of dry cotton bolls was made and moths began emerging out in April and went on emerging till June.

We have not been able to bread out any parasite.

2. *Chloridea obsoleta.*—Caterpillars were discovered in September boring in cotton bolls at Ferozepore and moths were also collected from that field. At Lyallpur caterpillars were found feeding on *Sida cordifolia* from April to June and on Holly hock in June, and later on they were found on cotton. This insect is the notorious bollworm of cotton in America.

On cottons in India it is never a pest, but deserves good looking after.

3. *Phycita infusella.*—Attacks the seedlings of cotton and sometimes causes much damage. The pest appears in April as soon as the crop comes out and is common uptil August, after that only few specimens are met with.

Two braconid and one dipterous parasites were bred from the caterpillars collected at Lyallpur Two chalcids and one braconid parasite were bred from the pupae collected at Lyallpur.

4. *Sphenoptera gossypii.*—During November 1919 the grubs of the insect did some damage to cotton near Lyallpur. Grubs and adults have been observed on Ratoon crop as early as June. In some parts of Madras, Berar and Bombay it has been reported a serious pest.

During July we bred a chalcid parasite from the grub.

5. *Acontia Sp.*—It was bad at Pirewala in August 1919. From caterpillars Tachinid parasites were bred.

6. *Taiache catena.*—Moths appear in Lyallpur as early as April. It was common in Pirewala It exhibited one very interesting feature. A large number of these caterpillars was collected at Pirewala in August and reared. Most of them pupated and a few came out in the same month, but the majority of these hibernated and emerged after the middle of May 19.0, still more interesting is the fact that one Tachinid parasite came out in August and another in May. From this it appears that the parasite hibernated along with the host. It is a very interesting fact.

7. *Sylepta derogata.*—Did great deal of damage at Chhanga Manga where in November 1919 almost 25 per cent of the crop was damaged.

8. *Myllocerus blandus.*—Is becoming a bad pest. It attacked cotton seedlings in April at Jahangirabad (Montgomery). Late sown crops usually escape damage. The experiment of 1918-19 were continued. Maize as trap crop was sown with cotton.

Jowar sown as fodder also suffered heavily. Experiments to check it in this crop are in progress.

Mango.—Mango Hopper. *Idiocerus Sp.* have become a very serious problem in the mango tract of the province, particularly in Hoshiarpur and Gurdaspur Districts. In some cases the owners of extensive orchards declare that they have not had a pice for years. One particular garden near Baghbanpura (Lahore) brought to its owner Rs. 6,000 some 6 years back and since then he has not had a fruit, except last year (1920) when we sprayed a few grafted trees in this orchard and he realised Rs. 500.

The life history of the insect was studied and spraying done in three gardens. In spite of the fact that the last year (1920) was not a good fruiting year our operations were encouraging.

The adult hopper retires into the crevices of the bark after the fruit is well set at about the end of May, and hibernates there through winter, congregating on the fresh inflorescence next season about February. It is at this time that the attack begins, numerous nymphs suck the juice of inflorescence and make it dry. In case of serious attack the inflorescence has a blighty look and the number of hoppers is so great that it is impossible to walk in such an orchard, when a branch is shaken the multitude of hoppers fly into the eyes and face and make it impossible to approach a tree.

It is mentioned in books that eggs are laid in the shoots, meaning thereby that the female makes a slit in the tissues of the plant and deposits eggs in this situation. A complete investigation by peeling of the bark, cutting sections, etc., gave no evidence in favour of the statement. Further examination showed that eggs were laid in almost all cases in the flowers not completely opened and between the whorls of sepel and petals. They are laid in groups and stand on ends. Eggs are oval, soft, creamy coloured and when the embryo is well-advanced the eyes show through the egg-shell as two spots. The number of eggs laid by a single individual could not be ascertained, but the fact that in the beginning of the season only few hoppers are present, and at the end the number is tremendously increased suggests that the eggs are laid in large numbers. The period of oviposition extended from the beginning of February to the end of March this year.

The nymphs started hatching out about the second week of March and their number increased very rapidly and fully hatched nymphs were observed as late as the end of April.

Freshly emerged adult hoppers were first observed on the 11th April. From the fact given above it appears that there is a single brood in a year, and that its life cycle takes two months—from the eggs to adult hoppers, and that chief damage is done by the nymphal stages.

The long stretch of period through which nymphs keep hatching make it impossible to kill all, or at any rate a large number of them, with one spraying, therefore it is essential to spray a tree oftener. One spraying should be done before the flowers open in order to kill the adult hopper that congregate at the period.

The inflorescence appear at different times on different trees and at different times on the same tree, and flowers in the same inflorescence open at different times. This is of advantage in some respects. There are thousands of flowers in the inflorescence and it is impossible for all of them to develop, and spraying is liable to injure a large number of flowers—thus some flowers are sure to escape injury to bear healthy fruit. If there are only 4 or 5 mangoes on an inflorescence the crop will be a bumper crop.

Second spraying should be done when nymphs have appeared in large numbers and a third when some of the fruit is set and fourth afterwards if essential.

Spraying at flowering time should, as a general principle, be discouraged, and this we are arranging for winter sprays.

In a garden at Ajudhiapur high trees were sprayed with good result, but a powerful machine is required for this purpose. A special long tube was designed for spraying these tall trees.

The insecticides used were—

(*i*) *Fish oil rosin soap.*—1 lb to 8 gallons of water (1 lb in 4 gallons damaged the flowers, 1 lb in 16 gallons did not kill nymph).

(*ii*) *Desi soap.*—Used in the strength of 1 lb to 8 gallons of water was found effective. It might be mentioned that some samples of desi soap contained as much as 30 per cent. wheat flour, and moreover as it is manufactured by cold process it always contains either free caustic soda or oil or both, and its insecticidal properties vary in different samples.

(*iii*) *Tobacco decoction and soap.*—2 lbs of tobacco refuse was soaked in 2 gallons of water for 24 hours and ½ lb of desi soap was dissolved in it. This was diluted with 7 parts of cold water. It was not very effective.

Fish oil rosin soap is the best, and cost of spraying is given below—

	Rs.	A.	P.
Cost of 3 cwt. 20 lbs.	75	5	3
Railway fare	27	14	0
	99	1	3

or Re. 0-3-4 per lb., this is sufficient for 1—2 trees for one spraying.

Labour charges—4 men were employed @ Re. 0-12-0 per day	3	0	0

and these could spray 32—48 trees in a day.

Labour charges per tree per day	0	1	6
Total cost per tree per spray	0	4	10
Total cost for three sprayings	0	14	6

In one garden at Ajudhiapur the following figures give some idea of the efficacy of spraying :—

Untreated trees.	*Treated trees.*
30 per cent. (25 trees), good fruit.	80·3 per cent., very good and good fruit.
30 per cent. (25 trees), little fruit.	15·5 per cent (11 trees), little fruit.
40 per cent. (36 trees), no fruit.	4·2 per cent. (3 trees), no fruit.

The larvæ of a beetle were seen boring into the inflorescence at various places. Its numbers were threatening, and it seems probable that a fair proportion of damage attributed to *tela* is caused by this. Its life history will be started next year and means adopted to check it.

Citrus.

Euphalerous citrii.—The study of the life history of the insect has been completed. Spraying operations against this serious pest of citrus have been a complete success. The following tables give the result of our operations (see table).

The pest is spreading in other parts of province also. Its first appearance is marked by the drying up of the top shoot of orange, malta, etc., and soon the whole plant is attacked, the leaves drop off and a dry skeleton is left. Spraying is the best remedy. District Board garden at Shahpur was in a frightful state and shall be taken in hand A full account will be published in Pusa bulletin or read at the next Entomological meeting. The cost of spraying works out at from 9 pies to Re. 0-1-6 per tree. Spraying is becoming very popular with the orange growers. A small chalcid parasite was bred out in large numbers from nymphs from Gujranwala.

Statement showing the increase in income by spraying against Euphalerous citrii.

Locality.	Garden.	Income during				Remarks.
		1917.	1918.	1919.	1920.	
		Rs.	Rs.	Rs.	Rs.	
Gujranwala ...	Sardar Jewa Singh garden.	120	700	300	1,200	Sprayed during 1918 and 1920. Severe attack during 1916 and 1917.
	Sardar Raj Singh garden.	25	400	500	700	Severe attack during 1916, 1917, and also in 1918. Spraying done in winter of 1917 and March 1918. No complaint of the attack after that.
	Lala Kanshi Ram garden.	*Nil*	*Nil*	*Nil*	150	Severe attack during 1918, 1919 and 1920. Owner did not get anything during 1918 and 1919. Spraying was done late in season in May 1920.
	District Board garden.	Not available.	1,100	1,400	Not available yet.	Attack was severe during 1919. Spraying done during 1919 and 1920.
	Jail garden ...	...	1,200	100	Not available yet.	The garden was sold on Rs. 2,000, but on account of severe attack the crop was altogether destroyed, and the contractor hardly realized Rs. 100. Spraying done during 1920.

Parasites.—The fact that the number of individuals in a species remains fairly constant is of general acceptance. Of the eggs laid by an insect usually in large number only a few batch, and of the larvæ still fewer survive, and at the end the number of adults is very much the same as in the previous generation. Insect parasites play a very important róle in maintaining a constant population. Although much progress has been made in other countries towards solving the problems of warfare on pests by means of insects, yet this most fascinating of the branches of Agricultural Entomology has, in this province, so far not received the attention it deserves. The difference of opinion that exists as to the efficacy of the parasites in checking pests makes the problem still more interesting.

Since my taking over the charge of the Entomological Section I hav devoted my attention towards this line, and as a first step towards fuller study of the problem have reared a large number of parasites from various pests belonging to different orders of insects (see list). The unfortunate fact that these parasites have not been identified so far makes the list incomplete, but arrangements are being made with an expert at the Natural History Museum, London, for necessary identification.

In a number of cases these parasites were kept with the host and eggs obtained in the laboratory and reared to adult stage—

	Orthoptera.				
1.	Mantid	Egg case ...		Chalcids.	
	Lepidoptera.				
2.	Hymenia facialis	Caterpillars ...	1.	Braconid.	
3.	Euproctus flava	Do. ...	2.	Dipterous.	
4.	Euzophera perticella	Do. ...	3.	Braconid.	
5.	Laphygma exigua	Do. ...	4.	Do.	
	Do.	Do. ...	5.	Dipterous.	
	Do.	Do. ...	6.	Chalcid.	
	Do.	Do. ...	7.	Braconid.	
6.	Plutella maculipensis ...	Pupa ...	8.	Metallic green chalcid.	
		Do. ...	9.	Black chalcid.	
		Do. ...	10.	Small braconid.	
7.	Leafrollers on (cassia fistula) ...	Caterpillar ...	11.	Black braconid.	
8.	Small pyrallid hanging from Sisso leaves.	Do. ...	12.	Braconid.	
9.	Leaf rollers on Kachnar ...	Do. ...	13.	Do.	
10.	Sylepta derogata ...	Do. ...	14.	Chalcid.	
11.	Phycita Infusella ...	Do. ...	15.	Small braconid.	
	Do.	Do. ...	16.	Chalcid.	
	Do.	Do. ...	17.	Braconid.	
	Do.	Do. ...	18.	Tachinid.	
	Do.	Pupa ...	19.	Chalcid.	
			20.	Do.	
	Do.	Do. ...	21.	Braconid.	
12.	Hyper parasite on Phycita ...	Caterpillars ...	22.	Chalcids.	
13.	Teneid on decaying bolls ...	Do. ...	23.	Black braconid.	
14.	Cirphis Sp.	Do. ...	24.	Tachinid.	
15.	Agrotis flammatra	Do. ...	25.	Big braconid.	
16.	Leaf minor on Pongamia glabra ...	Do. ...	26.	Small black chalcid.	
17.	Sugarcane borer	Do. ...	27.	Big braconid.	
18.	Caterpillar on Bhakra leaf ...	Pupa ...	28.	Big tachinid.	
19.	Tarache	Semi-loopers ...	29.	Do.	
	Do.	Do. ...	30.	Tachinid.	
	Do.	Do. ...	31.	Braconid.	

			Earias.				
20.	Earias	Eggs	...	32.	Small brown chalcid.		
	Do.	Caterpillars	...	33.	Small black chalcid.		
	Do.	Do.	...	34.	A braconid.		
	Do.	Do.	...	35.	Yellow braconid.		
	Do.	Do.	...	36.	Dipterous tachinid.		
	Do.	Do.	...	37.	Microbracon Sp.		
	Do.	Cocoons	...	38.	Big brown braconid.		
	Do.	Do.	..		Ditto.		
	Do.	Do.	...	39.	Big black chalcid I.		
	Do.	Do.	...	40.	Ditto	II.	
	Do.	Do.	...	41.	Ditto	III.	
	Do.	Do.	...	42.	Ditto	IV.	
	Do.	Do.	...	43.	Ditto	V.	
	Do.	Do.	...	44.	A braconid.		
		Coleoptera.					
21.	Bruchid beetles = Amblyrrhinus poricollis Boli. and Bruchus			45.	Metallic green chalcid.		
22.	vactabilis Gyl. ?						
	Ditto ... ditto ..		...	46.	Braconid.		
	Ditto ... ditto ...		...	47.	Various chalcids.		
	Ditto ... ditto ...	Cocoons	...	48	Black chalcid.		
23.	Sphenoptera gossypii ...	Grubs	...	49.	Braconid.		
		Do.	...	50.	Chalcid.		
		Do.	...	51.	Ditto.		
24.	Coccinella punctata ...	Pupa	...	52.	Black chalcid.		
		Diptera.					
25.	Agromyzae phaseoli ...	Maggots	...		Chalcids.		
26.	Leaf minor on pea	Do.	...		Various species of chalcids.		
27.	Do. on sonchus asper ...	Do.	...		Ditto.		
28.	Do. tropæœum ...	Do.	...		Chalcid.		
29.	Do. do.	Do.	...		Various chalcids.		
30.	Do. Kamoh	Do.	...		Chalcid.		
31.	Leaf Cineraria hybrida ...	Do.	...		Various chalcids.		
32.	Leaf on sonchus asper ...	Do.	..		Chalcid.		
		Hemiptera.					
33.	Euphalerous citrii	Nymphs	...		Chalcid.		
34.	A coreid bug	Eggs	...		Do.		
35.	Galls on mango leaf ...	...			Green chalcid.		
36.	Pentatomidæ	Eggs	...		Chalcids.		
37.	Coccids on cane		...		Do.		
38.	From mango inflorescence attacked by Idiocerus Sp.		...		Do.		
39.	Coreid bug	Do.	...		Do.		
40.	A pupa on grass	Do.			Braconid.		

Statement of spraying citrus trees against Citrus Psylla in 1920.

Serial No.	Locality.	Gardens treated.	Date of application.	Insecticide used with strength.	No. of trees sprayed.	Machine used.	Result.	Cost of spraying.	Remarks.
1	Gujranwala ...	District Board garden	I.—15th March 1920. II.—19th March 1920.	Fish oil rosin soap 1 lb—8 gallons water.	20 } 51 31 } Oranges and Maltas.	Knap sack sprayer. Four oak lime washing machine.	Garden was visited on 27th March 1920, and was found free from insects. Fruits commenced setting.	4 seers of the insecticide was consumed. Two men on each day for 4 hours daily (½ day) used from garden staff. Cost of spray per tree calculating at the base of Re. 0-8-0 per seer and Re. 1-0-0 a day for a labourer comes to Re. 0-0-6 without including labour charges and Re. 0-1-6 with labour.	Attack was mild. Spraying was also light.
2	Do. ...	Jail garden ...	16th March 1920. 17th March 1920.	Fish oil rosin soap 1 lb—8 gallons water.	79 } 218 139 } Oranges, Lemons, Malta.	Four oak lime washing machine.	A few flies were noticed in lemon plot only. None on malta or oranges.	12 seers of the insecticide used, 4 prisoners were used daily for two days. Calculating at the rate of Re. 0-8-0 per seer for the insecticide and Re. 1-0-0 a day for each man the cost of spraying for each tree comes to Re. 0-0-6 without labour and Re. 0-0-9 with labour.	...
3	Sargodha ...	Lala Kanshi Ram's garden.	5th May 1920. 6th May 1920.	Tobacco decoction—1 part stock solution 6 parts water.	Oranges Lemons Maltas } 215 ...	Small knap sack sprayer fitted with a long rubber hose 18.'	Stopped falling of unripened fruits. Very few flies left.	Total expenses Rs. 6-8-0 for tobacco and soap and 2 men for garden staff were used calculating at Re. 0-14-0 as for a labourer, the cost of each spraying per tree comes to Re. 0-0-6 without labour and Re. 0-0-8 with labour.	Spraying was done late in the season in May.
4	Do. ...	Sardar Jewa Singh's garden.	7th May 1920 ...	Tobacco decoction—1 part stock solution 6 parts water.	Maltas 50 ...	Small knap sack sprayer fitted with a long rubber hose 18.'	Flies were mostly killed. Condition of the trees improved.	Total expenses Rs. 2 for tobacco and soap, 2 men from garden staff were used for ½ day. Calculating Re. 0-14-0 for a man per day, the cost of spray for each tree comes to be 0-1-2 with labour, Re. 0-0-7 without labour.	Spraying was done late in the season in May.

Stored grains.—The loss from insects attacking stored grains even if estimated at as low a figure as 5 per cent. of the total produce of the province will, in case of wheat alone, work out to be 130,719·9 tons (2,614,398 tons being the total produce in 1918-19). The value of the wheat lost will work out to be about 165 lakhs, *i.e.*, about $\frac{1}{8}$ of the total revenue (231·52 to 235 07 lakhs of rupees during 1918-19) paid to the State. During my tours I visited a large number of mandies and examined many heaps of grain. Almost every heap that came under my observation was attacked. In some cases the damage was more than 50 per cent. In one particular case gram was being sold at 8 seers for a rupee when not a single grain was whole, and in 95 per cent nothing but the outer shell was left. With a view to solve the problem of grain storage I examined the stores of people belonging to various classes—cultivators who sometime store seed grain, Mahajan, agents, etc. In all cases I found the methods of storing above reproach, but store itself was the place most undesirable. Some people store seed grain in *Theeka* and it is kept in a well-ventilated room and is frequently watched and cleaned. This is the best method Some zamindars make earthen bins known as *Bharola*, which have got an opening at the bottom for taking the seeds and is covered at the top by means of an earthen lid. Most people put grain in a small room which they fill up completely and then block door with brick work or wooden boards. In the last case the attack is usually very bad and the room is not suited for any treatment, and it cannot be made air tight. Being one of the living rooms the use of the fumigants will not be without danger to life. The problem seems pretty hopeless at present, but when types of wheat are fixed and there is no danger of mixing good and bad wheat, big insect proof bins suitable for fumigation could be erected on co-operative lines.

We must, however, be ready for such times. The life histories of store insects have been worked out in the Punjab, but in a laboratory where the temperature, which is often the controlling factor in the number of broods, life cycle, hibernation, etc., is very different from that in a bin containing up to 3,000 maunds of wheat. It is desirable that we should study the whole problem fresh and find out—

(*a*) Temperature in a bin.

(*b*) Humidity in a bin.

(*c*) Life cycle of insect under the conditions prevalent in the bins or stores.

We tried fumigation experiments at Hoshiarpur in a godown in the mandi. Full dose of HCN gas and CS_2 were used, but without success. Toxicity of these substances in relation to temperature is yet to be determined. A full report has already been submitted.

Miscellaneous—*Euproctis flava* appeared near Lyallpur in Chak Nos. 208 and 279 on grapes vines. It was destroying leaves, damaging fruits and causing great discomfort to the labourers by crawling on the bodies and producing irritation by means of poisonous hairs. Spraying with water dislodged them and they were killed.

Bean fly—(*Agromyzæ phaseoli*).—The pest appeared in beans at the experimental area at the farm. Some parasites were bred out from it and the affected plants were removed.

Bruchid beetle.—On gram. Observations on the life history have been made.

Monophlebus.—*Monophlebus* was very bad in certain fruit gardens at Lahore and on trees in the compound of certain houses.

Cotton bands have not proved quite satisfactory. They are a perfect barrier against the insect crawling up, but squirrels, rats, and birds often make a breach in order to furnish nests with soft material, with the result that nymphs of Monophlebus crawling round the bands discover this breach and cross up. These animals thus frustrate the object of a band. Various bands of different kinds were tried. Mud-trough-bands were designed, and it is hoped that they will be the cheapest and much effective. They will be given a thorough trial next season.

(III).—Sericultural.

I have, during the last year, visited some of the chief silkworm rearing districts of the Province and have also spent some 6 weeks in Kashmir getting an insight into the sericulture problems. I shall shortly submit my views as regards the future development of sericulture in the Punjab.

During the last sericulture season (1920) in all 1,000 ozs. of silkworm seed was distributed in the Punjab as against 872 in 1919. In Gurdaspur District alone 782 ozs. of eggs were reared. (This includes 400 ozs. distributed by Sheikh Ghulam Saddiq of Amritsar.) In this district there are thousands of trees growing on the canal banksso far not utilized, and there is great scopes for increasing mulberry plantations. In Gurdaspur there is great future for sericulture. (For further information the tables page 13).

The entomological Section distributed 420 ozs. of eggs to the rearers and 100 ozs. were distributed through private agency. It is not desirable that some people should be allowed to exploit the actual rearers of silkworm, but as the staff is not sufficient we cannot possibly do the work of finding out rearers ourselves and are glad of this temporary help. Moreover, all the rearers employed by private agencies after a season or two come to the Entomological

section for seed, and further the prices are made known to every one and the interest of the rearers is safeguarded by giving large quantities of seeds to people whom we know to be reasonable in their dealings.

Amongst the new districts in which work was started Shahpur appears to be well suited for mulberry plantations and for silkworm rearing.

Mulberry plantations.—Very little has been accomplished. The few nurseries are not doing well. On the whole question of mulberry plantation was in an unsettled condition and nothing could be done. We must soon evolve some sort of definite policy of mulberry cultivation and a machinery to put it into action.

It is unfortunate that in some districts mulberry trees on the roadside are being cut down. Our protests do not seem to have been effective.

M. AFZAL HUSSAIN,

The 30th August 1920. *Entomologist to Government, Punjab, Lyallpur.*

Statement of sericulture for years 1918, 1919, 1920.

Year.	Total seed imported.	Seed distributed by Sheikh Ghulam Sadiq.	Seed distributed by Entomological Section.	Number of rearers to whom seed was distributed by Entomological Section.	Total yield of dry cocoons from seed distributed by Entomological Section.	Average yield of dry cocoons per oz. of seed.	Highest yield of dry cocoons per ounce of seed.	Total yield of dry cocoons brought for auction.	Total price realized.	Price per 40 seers of dry cocoons.	Average price per oz. of seed.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
	Ozs.	Ozs.	Ozs.		Seers.	Seers.	Seers.	Seers.	Rs.	Rs.	Rs. A. P.	
1918	921	(*i*) 415	506	165	(*i*) 2,992	5·9	20	2,992	(*ii*) 10,429	190-A 140-B 120-C	20 9 4	(*i*) Sheikh Ghulam Sadiq gave out his yield as 2,787¾ seers. (*ii*) Sheikh Ghulam Sadiq paid Rs. 8,195-14-3. (*iii*) Since 1918 we have not had any figures from Sheikh Ghulam Sadiq. (*iv*) Exceedingly bad seed. (*v*) 180 ounces was distributed in Gurdaspur privately, exact figures are not available. 100 ounces was reared by rearers in this locality. Their number might be 45. (*vi*) This does not include yield of cocoons from 35¾ ounces, most of which was reeled privately. (*vii*) 100 ounces from Chebrier gave less than 20 per cent. hatching and reduced the average yield. (*viii*) Remaining yield not brought to our auction, but sold privately to reelers. (*ix*) The total yield from 600 ounces will probably be 3,420 seers. (*x*) Yield from Sheikh Ghulam Sadiq 400 ozs. is not included in this statement. It might be put at 2,000 seers, and number of his rearers at from 150 to 200.
1919	872	(*iii*) 400	472	206	241	(*iv*) 0·7	(*iv*) 4⅞	241	1,191	200-A 190-B	(*iv*) 3 5 4	
1920	1,000	(*iii*) (*x*) 400	600	(*v*) 301	(*vi*) 2,964¾	(*vii*) 5·7	(*vii*) 17	(*viii*) 1,592$\frac{3}{10}$	9,034	227	32 5 7	

Statement of distribution of silkworm seed in the Province for years 1918, 1919, 1920.

No.	District.		1918.			1919.			1920.			No. of rearers 1920.	Remarks.
			1	2	3	1	2	3	1	2	3		
1	Gurdaspur	1	324	...	...	292	...	...	382	...	...		
		2	...	29	...	...	35	...	...	64	...		
		3	...	...	41	...	...	30	...	...	74	138	Sheikh Ghulam Sadiq has been distributing 400 ozs. in Gurdaspur District: Number of his rearers is not included.
2	Hoshiarpur	1	72	...	...	68	...	...	70½	...	...		
		2	...	13	...	...	32	...	...	30	...		
		3	...	...	27	...	...	9	...	...	17	47	
3	Sialkot	1	41½	...	...	59	...	...	65	...	...		100 ozs. were reared in Gurdaspur in 1920. Number of these rearers not known.
		2	...	12	...	...	29	...	...	32	...		
		3	...	...	23	...	...	9	...	...	11	43	Trees are being cut down.
4	Ambala	1	29	...	...	20	...	...	14½	...	...		
		2	...	...	...	...	25	...	...	18	...	18	Many mulberry trees are being out down.
		3	...	...	...	...	...	16	...	...	...		
5	Kangra	1	9	...	...	12	...	...	14½	...	...		
		2	...	...	...	...	6	...	...	3	...		
		3	...	...	9	...	...	...	...	...	3	6	
6	Jullundur	1	1	...	...	4	...	...	6	...	...		
		2	...	...	...	...	1	...	...	1	...	1	
		3	...	...	1	...	...	...	...	...	...		
7	Lahore	1	½	...	...	...	...	...	½	...	...		
		2	...	2	...	...	1	...	...	1	...	2	
		3	...	...	...	...	...	22	...	...	1		
8	Amritsar	1	25	...	...	4½	...	...	½	...	...	2	25 ounces in 1918 was actually reared at Gurdaspur
		2	...	2	...	...	6	...	...	2	...		
		3	...	...	6	...	...	...	...	...	...		
9	Lyallpur	1	½	...	...	3	...	...	4½	...	...		Not suitable for sericulture.
		2	...	...	...	...	...	...	...	1	...		
		3	...	...	...	...	...	2	...	...	1	2	
10	Kulu	1	...	...	...	½	...	...	2	...	...		
		2	...	...	...	...	...	...	...	2	...		
		3	—	...	...	...	...	2	...	...	3	5	
11	Shahpur	1	...	...	...	½	...	...	16½	...	...		
		2	...	...	...	...	...	...	...	...	...		
		3	...	...	..	...	.	1	...	...	16	16	Work started this year; very successful.
12	Karnal	1	...	...	...	...	...	...	14½	...	...		
		2	...	...	...	...	...	...	...	...	...		
		3	...	...	...	...	...	...	...		17	17	Work done for the first time; district too warm for sericulture.
13	Rohtak	1	...	...	...	...	...	...	4	...	...		
		2	...	...	...	...	...	...	...	...	...		
		3	...	...	...	...	...	...	...	...	½	4	Ditto ditto.
	Miscellaneous		5	...	...	8½	...	...	7	...	...		Number of rearers not known, mostly students, etc.
	Total ...		506	? 58	? 107	472	? 135	? 71	600	? 154	? 147	301	Total number of rearers may be estimated at 450.

Note.—Column (1) Horizontal and verticle gives number of ounces distributed.
(2) Ditto ditto old rearers.
(3) Ditto ditto new rearers.

A series of Manurial experiments at Lyallpur, 1912—17.

The experiments now reviewed were started with the object of discovering the "dominant" manurial ingredient for each of the common crops of the canal colonies. Any consideration of the economic aspects of the question was deliberately postponed for subsequent investigation. The way in which the crops are rotated, even, is not typical of the practice of the district. The crops of the two seasons are grown in two separate series. In the kharif series, Sugarcane, Maize and Cotton, and in the rabi series, Wheat, Toria and Gram, follow each other in the order given. The intensity of cropping is thus 100 per cent. (one crop per year) which is the average of the district as a whole. But, on the other hand, it is not common for rotations consisting of the crops of one season only to be adopted at all, and this is never done when the land is manured. The customs of the local zamindars as to the order in which crops are rotated are still somewhat variable; but on one point there is a general agreement. For whenever a field receives a dressing of farmyard manure, which is the only manure commonly used, then two crops are always grown in succeeding seasons without any intervening fallow period.

The utility of the results of these experiments for practical purposes is also greatly diminished by the absence of any unmanured control plots. Between each of the manured plots of one fifth of an acre there is a very narrow strip of unmanured land. But these strips are very small and are relatively greatly affected by borders effects—effects which in manurial experiments on irrigated land are by no means negligible. Thus although the yields of these strips have been systematically recorded, they are useless for any strict comparisons, they have only been used in the preparation of Table I and in the calculation of the figures for probable Error" in Table II.

Farmyard Manure.

In each series in each year there is a plot manured with farmyard manure consisting chiefly of dung. In Table I the yields of these plots have been compared to the yields of the adjacent unmanured strips. Very similar figures are obtained by comparing the yields of these plots with the average of the yields of all the unmanured strips instead of only the two adjacent ones.

Sugarcane gives a substantially increased yield on the manured plot, the increase amounting to 20—40 per cent in all normal years: it is only in the years 1911 and 1914, when the whole crop was inferior, that the relative increase due to manuring is less. (For actual yields see Table II.) In each of the four years when the crop of maize was average to good, the manure causes an apparent increase of 10—20 per cent. The effect on cotton is more variable, though the cause of the variations is not obvious, as the crops were throughout average to good. In the case of wheat the actual yields are very consistent from year to year, and the increases due to the manure are also regular though small, averaging only 1½ per cent. The effect of the manure on the yields of Toria varies considerably from year to year. But the actual yields of the whole crops of Toria vary greatly from year to year; for this crop is greatly affected by several seasonal factors. Generally the return from the manure is greatest in the best years. There is very little evidence in these results of any increase in the yield of gram as a result of applying farmyard manure.

So far as they go these results accord exactly with the common ideas and general practices of the farmers in the district. Sugarcane and Maize are regarded as most exhaustive crops and are always grown on the best land and receive most of the available manure. Cotton is regarded as less exhaustive, and is only manured when it is not preceded (as it is in these experiments) by any fallow period. Of the rabi crops Toria is regarded as the most exhaustive and is sometimes manured. Gram is regarded as the least exhaustive of the common crops and is very seldom manured. Certainly no one manures gram when it is grown, as it is in these experiments, on land that has been fallow for several months.

"Artificial" Manures.—The results from the application of various artificials manures are given in Table II, parts *a* and *b*. In these tables the yields from the plots manured with artificials are compared with the yields from the plots treated with farmyard manure. The yields and mean yields of the narrow unmanured strips are also given; but as explained before too much weight cannot be attached to comparisons between the manured plots and these strips.

Lime.—The yields from the limed plots are poor except when it is applied to wheat and gram. It is not unlikely that the lime may cause an increase in the yield of the leguminous gram crop; and the apparent increase which it causes in the yield of wheat is sufficiently great possibly to represent more than experimental errors. Apart from these two cases the lime apparently fails to give any important return.

Gypsum.—Except in one case (that of maize in 1911), there is no evidence in these experiments of any return from the applications of gypsum. Excepting in that one case, the yield from the gypsum plot is less than that from the dunged plot in all cases where the latter was itself at all superior to the unmanured strips. In the case of the gram crops and the cotton crop of 1914, where the farmyard manure itself produced little increase,

there the yields of the gypsum plot and the farmyard manure plots are substantially equal. Comparing the yields of the gypsum plot and the unmanured strips confirms the failure of gypsum. The one exceptional case is not easily understood ; but it is significant that it occurred in the first year of the experiments when there were also one or two other exceptional results, so that it may have been due to an irregularity in the soil which later disappeared under the continued good cultivation.

Bonemeal.—The yields from the plot (No. 4) manured annually with 300 lbs. of bonemeal is less than the yield from the dunged plot in every case except that of cotton in 1915, in which year the latter was itself inferior to the unmanured strips. The comparison with the unmanured strips, so far as it goes, shows no evidence of any very substantial returns from the manure. The yields of plot 24, treated with Bonemeal and lime look more encouraging at first sight ; but the only really marked increases, apparently due to the manure, are in the sugarcane crop of 1914, which was practically a failure, and in the gram crops, where lime alone seems also to be beneficial. Plot 30 manured with Bonemeal, Lime and Ammonium Sulphate can also be compared with Plot 26 which is treated with only Lime and Ammonium Sulphate. On the whole the yields of the two plots are approximately equal. The former is distinctly superior in one year, but this is counterbalanced by a case in which it is equally inferior.

Basic Slag.—In the first year of the experiment Basic Slag apparently gave a good return when applied to Sugarcane ; but this result is not confirmed by the yields in the later years 1913 and 1916. It has not been fairly tested on Maize ; it apparent does no good when applied to cotton. It appears to cause a slight increase in the yields of wheat and gram, but is inferior to lime alone in this respect. It causes little apparent increase in Toria.

These experiments are not such as to justify the absolute negative conclusion that phosphatic manures cause no increase in these crops here ; but they certainly appear to justify the conclusion that these manures do not, under the conditions of these experiments, cause any such increases in yields as would render their use profitable.

Soluble Nitrogenous Manures.—The results from the application of heavy dressings of these manures are very different from the results with phosphatic manures. On sugarcane and maize where the 4-ton dressings of dung applied annually caused substantial and consistent apparent increases, there these dressing of soluble nitrogeous compounds cause much greater increases in the yields. In the case of cotton, where the returns from the dung are variable the effect of these manures varies similarly. In 1914 and 1917 when the dung only gave a slight return, then these manures gave an equal or even lesser return. In 1911, 1913, 1917, when the dung gave more substantial returns, the returns from the soluble Nitrogenous manures were generally greater still. On wheat the return from these manures is equal to, or less than, that from the " farmyard manure ; " and on Toria also they roughly follow the latter but are liable to rather greater variations. On gram there is no evidence of any return from the application of these manures alone and the increases where they are used in conjunction with lime may be due to the lime.

It may be mentioned that most of the more important of these results have been confirmed by other simpler experiments in other fields under similar conditions.

Conclusions.—So far as can be seen from these experiments Nitrogen is by far the most important element of plant food controlling the growth of crops grown under the conditions of these experiments. The application of Nitrogenous manures to sugarcane and maize always markedly increases the yield ; but on other crops such manures do not always give the returns that would be expected on the analogy of manurial experiments in temperate climates. On cotton the results of such manuring are negligible in some years. On wheat, the light dressing of farmyard manure causes a fairly consistent increase which is generally greater than that caused by the relatively heavy dressings of soluble Nitrogenons manures ; on Toria the results from the application of Nitrogen in either form are considerable in favourable seasons. Gram gives little return for manuring. Lime is apparently beneficial to gram and in a less degree to wheat ; Gypsum and Phosppatic manures fail to give a substantial return for their application to any crop. There is reason to believe that the results of the application of nitrogenous manures depend partly on the length of the fallow period preceding the sowing of the crop.

O. T. FAULKNER,

Deputy Director of Agriculture, Lyallpur.

Table I.

THE YIELDS OF THE PLOTS TREATED ANNUALLY WITH 4 TONS FARMYARD MANURE ARE COMPARED TO THE AVERAGE OF THE YIELDS OF THE TWO UNMANURED ADJACENT STRIPS (FOR ACTUAL YIELDS SEE TABLE II).

"KHARIF" SERIES.

Plot No.	Sugarcane.			Maize.			Cotton.		
6-K.	*1911.* 113·8	*1913.* 128·2	*1916.*	*1914.* Crop failed.	*1917.* Crop failed.		*1912.* 109·2	*1915.* 91·3	
17-K.	*1912.* 123·2	*1915.* 141·6		*1911.* 108·1	*1913.* 109·0	*1916.* Crop failed	*1914.* 105·3	*1914.* 104·2	
28-K.	*1914.* 106·3	*1917.* 127·6			*1912.* 122·1	*1915.* 121·8	*1911.* 131·6	*1913.* 114·4	*1916.* 111·3
Average	123			115			110		

"RABI" SERIES.

Plot No.	Wheat.		Toria.		Gram.	
6-R.	*1911-12.* 118·0	*1914-18.* 117·4	*1912-13.* 115·2	*1915-16.* 159·7	*1913-14.* 105·9	*1916-17.* 113·0
17-R.	*1913-14.* 107·1	*1916-17.* 114·8	*1911-12.* 141·0	*1914-15.* 103·4	*1912-13.* 90·6	*1915-16.* 98·6
28-R.	*1912-13.* 105·3	*1915-16.* 118·7	*1913-14.* 99·4	*1916-17.* 126·6	*1911-12.* 95·9	*1914-15.* 113·6
Average	114		124		103	

Table II A.

Plot No.	Treatment.	Area in acres.	Sugarcane.						Maize.				Cotton.			
			1911.		1913.		1916.		1914.		1917.		1912.		1915.	
			Mds.		Mds.		Mds.		Failure.		Failure.		Mds.		Mds.	
3	Unmanured	0·056	16·1	...	28·5	...	24·9	...	...	...	...	...	4·5	...	8·6	...
4	Bone meal at 304 lbs. per acre	0·2	15·4	82·8	30·8	94·1	35·8	94·4	...	...	...	...	5·0	94·3	8·2	103·8
5	Unmanured	0·056	16·9	...	29·6	...	36·7	...	...	...	...	...	5·3	...	9·1	...
6	Farmyard manured at 8960 lbs. per acre.	0·2	18·6	100·	32·7	100·	37·9	100·	...	...	...	...	5·3	100·	7·9	100·
7	Unmanured	0·056	15·8	...	21·4	...	26·3	...	...	...	...	...	4·4	...	8·2	...
8	Basic slag at 656 lbs. per acre	0·2	20·9	112·3	23·3	71·2	29·2	77·0	...	...	...	...	4·6	86·8	8·9	112·6
9	Unmanured	0·056	21·2	...	21·4	...	29·9	...	...		...	...	5·6	...	7·7	...
10	Lime at 560 lbs. per acre ...	0·2	17·8	95·7	21·?	66·9	2·69	70·9	...	...	...	...	5·2	98·1	5·1	64·5
1	Mean of unmanured plots ...	...	17·5	...	25·2	...	29·4	...	...		...	...	4·95	...	8·4	...
	P. E. of difference of two plots	...	±1·4	...	±2·4	...	±2·9	...	...	...	...	...	±0·32	...	±0·32	...

			Sugarcane.				Maize.				Cotton.			
			1912.		1915.		1911.		1913.		1916.		1914.		1917.	
									Mds.		Failure.					
13	Calcium cynamide at 397 lbs. per acre.	0·2	25·0	122·6	31·1	97·5	33·2	124·3	41·2	128·3	...	...	6·5	94·2	12·4	100·8
14	Unmanured	0·056	12·5	...	23·6	...	30·3	...	31·2	...	...	...	4·9	...	10·7	...
15	Calcium nitrate at 550 lbs. per acre.	0·2	21·0	102·9	35·6	111·6	32·1	120·2	37·2	115·3	...	...	6·1	88·4	12·1	98·3
16	Unmanured	0·056	12·5	...	30·5	...	29·8	...	24·5	...	...	...	6·2	...	11·6	...
17	Farmyard manured at 8,960 lbs. per acre.	0·2	20·4	100·	31·9	100·	26·7	100·	32·1	100·	...	...	6·9	100·	12·3	100·
18	Unmanured	0·056	20·6	...	14·6	...	19·6	...	34·4		...	...	6·9	...	12·0	...
19	Ammonium sulphate at 318 lbs. per acre.	0·2	24·4	119·6	41·5	130·9	36·9	138·2	33·7	105·0	...	...	7·6	110·1	10·1	82·1
20	Unmanured	0·056	10·2	...	23·2	...	31·2	...	23·6	...	...	...	5·8	...	11·7	...
21	Gypsum at 560 lbs. per acre ...	0·2	7·3	35·8	17·7	55·5	36·9	138·2	26·4	82·2	...	...	7·2	104·3	10·8	87·8
	Mean of unmanured plots ...	...	13·9	...	22·9	...	27·7	...	28·4	...	...	...	5·95	...	11·5	...
	P. E. difference of two plots ...	...	±2·49	...	±3·58	...	±2·99	...	±2·87	...	...	...	±0·46	...	±0·31	...

			Sugarcane.				Maize.				Cotton.					
			1914.		1917.		1912.		1915.		1911.		1913.		1916.	
											Mds.					
24	Bonemeal at 304 lbs. + lime 560 lbs per acre.	0·2	15·0	147·0	26·2	92·2	27·9	103·9	25·1	112·6	7·0	89·7	8·9	107·2	10·3	87·3
25	Unmanured	0·056	10·2	...	23·4	...	26·2	...	19·3	...	6·9	...	9·6	...	10·7	...
26	Ammonium sulphate 318 lbs. + lime 560 lbs. per acre.	0·2	17·5	171·5	38·8	136·6	33·9	125·1	23·4	104·9	10·1	129·4	9·6	115·6	13·4	113·5
27	Unmanured	0·056	10·7	...	20·9	...	23·3	...	17·0	...	6·45	...	7·0	...	10·5	...
28	Farmyard manure at 8,960 lbs. per acre.	0·2	10·2	100·	28·4	100·	27·1	100·	22·3	100·	7·8	100·	8·3	100·	11·8	100·
29	Unmanured	0·053	8·5	...	23·6	...	21·9	...	19·6	...	5·4	...	7·5	...	10·7	...
30	Bonemeal 304 lbs. + lime 560 lbs. and ammonium sulphate 318 lbs. per acre.	0·2	14·7	144·1	39·4	138·7	36·2	133·5	26·2	117·4	10·7	137·2	10·6	127·7	16·6	140·6
31	Unmanured	0·056	6·7	...	15·6	...	25·5	...	17·8	...	8·2	...	7·8	...	13·4	...
32	Superphosphate 291 lbs. + calcium nitrate 450 lbs. + ammonium sulphate 318 lbs. per acre.	0·2	14·7	144·1	38·2	134·5	30·4	112·1	26·9	120·6	10·7	137·2	10·2	122·9	18·9	160·1
33	Unmanured	0·056	5·3	...	16·9	...	25·9	...	22·4	...	7·1	...	6·6	...	12·1	...
	Mean of unmanured plots ...	...	8·3	...	20·1	...	24·3	...	19·2	...	6,8	...	7·7	...	11·5	...
	P. E. of difference of two plots	...	±1·08	...	±1·75	...	±0·98	...	±0·98	...	±0·48	...	±·55	7·1%	±0·59	...

Table II B.

No. of plot.	Treatment.	Area per acre.	Wheat. 1911-12. Mds. per acre.	Wheat. 1911-12. Percentage in terms of F. Y. plot.	Wheat. 1914-15. Mds. per acre.	Wheat. 1914-15. Percentage in terms of F. Y. plot.	Toria. 1912-13. Mds. per acre.	Toria. 1912-13. Percentage in terms of F. Y. plot.	Toria. 1915-16. Mds. per acre.	Toria. 1915-16. Percentage in terms of F. Y. plot.	Gram. 1913-14. Mds. per acre.	Gram. 1913-14. Percentage in terms of F. Y. plot.	Gram. 1916-17. Mds. per acre.	Gram. 1916-17. Percentage in terms of F. Y. plot.
3	Unmanured	0·056	22·7	..	14·2	...	15·6	...	7·2	...	15·1	...	17·6	...
4	Bonemeal at 304 lbs. per acre	0·2	25·4	95·8	15·9	90·8	14·5	100·7	9·8	82·3	17·1	96·6	18·4	90·2
5	Unmanured	0·056	20·0	...	14·7	...	13·4	...	7·3	...	16·0	...	18·3	...
6	Farmyard manure at 8,960 lbs. per acre	0·2	26·5	100·0	17·5	100·0	14·4	100·0	11·9	100·0	17·7	100·0	20·4	100·0
7	Unmanured	0·056	24·9	...	15·1	...	11·6	...	7·6	...	17·4	...	19·3	...
8	Basic slag at 656 lbs. per acre	0·2	26·7	100·7	17·6	100·6	13·4	93·0	9·2	77·3	17·1	96·6	20·9	102·4
9	Unmanured	0·056	21·4	...	16·5	...	13·8	...	6·7	...	16·9	...	18·3	...
10	Lime at 560 lbs. per acre	0·2	28·1	106·0	20·6	117·7	13·2	91·6	5·4	45·4	22·0	124·3	24·0	117·6
	Mean of unmanured plots	...	22·3	...	15·1	...	13·6	...	7·2	...	16·3	...	18·0	...
	P. E. difference of two plots	...	±1·14	...	±0·54	...	±0·90	...	±0·21	...	±0·55	...	±0·22	...
			1913-14		1916-17		1911-12		1914-15		1912-13		1915-16	
13	Calcium cynamide at 396·7 lbs. per acre	0·2	19·7	94·2	25·0	92·2	22·7	93·0	6·6	86·8	20·9	81·6	21·8	99·0
14	Unmanured	0·056	20·0	...	27·4	...	17·8	...	5·3	...	22·3	...	19·8	...
15	Calcium nitrate at 550 lbs. per acre	0·2	20·1	96·1	27·9	102·9	18·7	76·6	6·5	85·5	23·9	93·7	23·6	107·2
16	Unmanured	0·056	21·8	...	23·2	...	14·7	...	5·8	..	27·6	...	22·8	...
17	Farmyard manure at 8,960 lbs. per acre	0·2	20·9	100·	27·1	100·	24·4	100·	7·6	100·	25·6	100·	22·0	100·
18	Unmanured	0·036	17·2	...	24·0	...	19·9	...	8·9	...	28·9	...	21·8	...
19	Ammonium sulphate 318 lbs. per acre	0·2	17·9	85·6	23·2	85·6	22·0	90·1	7·4	97·3	26·2	102·3	20·1	91·3
20	Unmanured	0·056	18·3	...	24·5	...	12·5	...	5·3	...	27·6	...	21·3	...
21	Gypsum at 560 lbs. per acre	0·2	18·7	89·4	25·0	92·2	15·2	62·3	5·0	65·8	25·7	100·4	20·6	93·8
	Mean of unmanured plots	...	19·3	...	24·8	...	16·2	...	6·3	...	26·6	...	21·1	...
	P. E. difference of two plots	...	±1·10	...	±1·00	...	±1·79	...	±0·94	...	±1·60	...	±0·66	...
			1912-13		1915-16		1913-14		1916-17		1911-12		1914-15	
24	Bonemeal 304 lbs. + Lime at 560 lbs. per acre	0·2	29·1	113·2	25·1	95·1	8·7	102·3	12·3	84·8	20·4	142·6	19·7	110·1
25	Unmanured	0·056	24·5	...	21·4	...	8·1	...	9·8	...	16·1	...	16·0	...
26	Lime 560 lbs. + Ammonium sulphate 318 lbs. per acre	0·2	25·6	99·6	26·7	101·1	12·7	149·4	16·7	115·1	18·7	116·7	18·4	102·8
27	Unmanured	0·056	22·5	...	22·7	...	7·3	...	10·2	...	12·9	...	15·9	...
28	Farmyard manure at 8,960 lbs. per acre	0·2	25·7	100·	26·4	100·	8·5	100	14·5	100·	14·3	100·	17·9	100·
29	Unmanured	0·056	26·3	...	21·8	...	9·8	...	12·7	...	16·9	...	15·6	...
30	Bonemeal 304 lbs. + lime 560 lbs. + ammonium ulphate 318 lbs. per acre.	0·2	26·1	101·5	25·3	95·8	13·4	157·6	18·1	124·8	16·5	115·4	17·5	97·7
31	Unmanured	0·056	26·8	...	20·9	...	11·5	...	14·9	...	17·4	...	12·0	...
32	Superphosphate 231 lbs. + [Calcium nitrate 550 lbs. + ammonium sulphate 318 lbs. per acre.	0·2	19·1	74·3	23·6	89·4	15·7	184·7	18·9	130·3	16·0	111·9	16·2	90·5
33	Unmanured	0·056	24·5	...	24·5	...	8·9	...	16·9	...	...	...	12·9	...
	Mean of unmanured plots	...	24·9	...	22·3	...	9·1	..	12·9	...	15·2	...	14·5	...
	P. E. difference of two plots	...	±0·80	...	±0·67	...	±0·76	...	±1·14	...	±1·11	...	±0·89	...

26 DA—516—18-6-21—SPPG Lahore.

Report on the Operations of the Department of Agriculture, Punjab, FOR 1920-21.

ANNUAL EXPERIMENT RECORD.

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REPORT

ON THE OPERATIONS OF THE

DEPARTMENT OF AGRICULTURE, PUNJAB,

FOR THE YEAR ENDING 30TH JUNE 1921.

PART II.

Annual Experiment Record.

Lahore :
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRINTING, PUNJAB.
1922.

Index. *Pages.*

1. Experiments in Economic Botany by Mr. D. Milne, Economic Botanist. 1

2. Experiments in Agricultural Chemistry by Doctor P. E. Lander, Agricultural Chemist. 37

3. Experiments in Entomology and Sericulture by Mr. M. Afzal Hussain, Entomologist. 52

4. Experiments at the Lyallpur Agricultural Station by Mr. H. R. Stewart, Professor of Agriculture. 68

5. Experiments at the Gurdaspur Agricultural Station by M. Sultan Ali, Deputy Director of Agriculture. 114

6. Experiments at the Sargodha Seed Farm by M. Sultan Ali, Deputy Director of Agriculture. 146

7. Experiments at the Hansi Agricultural Station by Sardar Darshan Singh, Deputy Director of Agriculture. 158

Report of the Economic Botanist to Government, Punjab, for the year ending 30th June 1921.

PART II.

Staff.—I was on combined leave till 28th January 1921 and Lala Jai Chand, M. Sc., Assistant Professor of Botany, officiated as Economic Botanist while I was away. Chaudhari Ali Muhammad, L. Ag., Agricultural Assistant, Botanical Section, officiated as Assistant Professor of Botany *vice* Lala Jai Chand.

Chaudhari Mohammad Akbar, L.Ag., and Bhai Ratan Singh, L. Ag., were added to the staff as Agricultural Assistants. The former has been assisting with work on cottons and the latter with work on wheats owing to pressure of work on these crops.

Deputation work.—When I was on leave I visited parts of Belgium and France devastated by the War and saw the land reclamation work being done there. I also saw the Agricultural College at Gemblaux and its facilities for work. Later I was put on deputation by Government and made enquiries in Britain regarding Milling and Baking tests of wheats; cotton testing, spinning, marketing, etc. I also visited a number of Colleges and Research Institutes in Britain enquiring into the workings of these institutions. Several special reports of the work done while on deputation have been sent to the Director of Agriculture, Punjab.

Wheats.

A few remarks regarding season and its effect on the wheat crop—

Rainfall at Lyallpur.

Month.	*Inches.*
June	1·25
July	0·49
August	3·17
September	1·53
October	0·00
November	0·00
December	0·05
January	0·09
February	0·52
March	0·00
April	0·00
May	0·00
Total ...	6·60

As will be seen from the above data the season was an extremely dry one for the wheat crop. It was also very hot in spring at Lyallpur. Indeed it was the driest season on record. Our average rainfall here is about 14 inches, of which about 5 inches usually fall between the end of September and the end of May. The maximum temperatures were exceptionally high from about the 28th of March till the middle of April, and hot dry winds blew occasionally during the same period (see graphs of temperature and humidities opposite). These hot dry winds caused damage to the crop by shrivelling the grains, and this damage was very great where the lands contained little moisture. We have noticed that if the maximum temperatures in the shade rise to near 100° F., and hot dry winds blow before wheat grains reach their full size and are well stocked with milk, shrivelling of the grain results if the soil contains little water; and if the maximum temperatures rise over 100° F., and hot dry winds blow at that period the grains tend to shrivel up in spite of everything. This has been seen repeatedly in previous years in the case of late ripening varieties. Our common types of Punjab wheats come into flower at Lyallpur about the beginning of March; the grains reach their full size in the first week of April, and are ripe about the middle of April; therefore the hot dry winds this year caught the crop at a very critical stage. Similar hot dry winds had an important effect on the quality of the grain and outturn per acre not only at Lyallpur but elsewhere in the Province. The extent of the damage varied with the water supply in the soil.

At Lyallpur rust made its appearance, but very late in April instead of in February as usual. It did practically no damage to the crop. The very dry season and clear sky in February and March were probably the causes of comparative freedom from the disease.

Total sowings and land.—We had about 350 sowings of wheat under observation at Lyallpur, and they occupied about 24 acres of land, of which 6 acres were non-experimental. Three acres of the non-experimental crop were on trenched land in square No. 28, and the remaining three acres on land in square No. 30, recently handed over to us by the Jail authorities.

Of the 18 acres of experimental wheats 7½ were in square No. 28, 2½ in square No. 46, and 8 were in square No. 31. The land in squares Nos. 28 and 46 has been specially set apart for wheat and cotton testing since 1908, and that in square No. 31 since 1916.

The soil in square No. 28 is a medium loam of fairly even quality; that in square No. 46 is more sandy and irregular ; while the soil of about ¾th of the area in square No. 31 is a medium loam of fairly even quality, and the remaining ¼th is a poorer sandy loam.

Cultivation and irrigation.—The experimental land was under cotton in the previous year and received the following cultivation between the time the cotton crop was removed and the time of preparation of the wheat seed bed :—

Ploughings with Rajah plough	1
Cultivation with spring-toothed harrow	1
Ploughings with Desi plough	8

To prepare the seed bed the land get—

Irrigation	1
Ploughings with Desi plough	2

No manure was applied.

During the wheat-growing period, only one weeding was done. The crop had four irrigations after being sown.

Punjab classified types of wheats.—The 25 types of originally classified Punjab wheats were each sown as usual on a 1/32 acre plot to maintain a stock of seeds in the Department for demonstration purposes, etc.

Later found types of Punjab wheats.—Thirty-six later found types of Punjab wheats discovered during wheat surveys, etc., were sown in square No. 46 in long narrow plots, each 1/32 acre area, with Punjab No. IX as a standard at intervals to indicate variations in the quality of the soil, etc. (see Statement A, pages 20,21). The soil in the field is very uneven in texture and generally poor ; therefore the results are not very comparable. However I may state that types Nos. 19-E, 19-F, 24-B, 20-C, 20-B, 8-A, 20-A, 19-G, 18-B, 19-B, 19-C, 17-A, 17-B, 17-C, 24-A, 25-B, 19-H, and 9-C gave the best yields, and stand in the above order.

Another 34 types of Punjab wheats discovered during the most recent district surveys *i.e.* those in Hoshiarpur, Muzaffargarh, Rawalpindi, Ferozepore and Gujrat Districts, were similarly grown in square No. 28 on 1/32 acre plots interstripped with Punjab No. IX as a standard (see statement B, page 22).

Hoshiarpur types Nos. 6 and 7 and Muzaffargarh Nos. 9, 10, 13 and 14 have given better results than the standard. Hoshiarpur Nos. 6 and 7 did very well last year also.

Selected wheats in square No. 31.—Punjab types 8-A, 8-B, 9-C, 16-A, 17-B, cross 2 and cross 3 together with Pusa 12 were tested against Punjab 11 in square No. 31 on plots of ⅛ acre each, in two sets of experiments. In the first set of experiments the wheats were sown on 26th-27th October 1920 and in the second set on 12th-13th November 1920. Both in the early and in the late sowings, the plots were in duplicate. Statements C, D, E and F on pages 23-24 show the outturns of crop got from the types, and the order in which the plots were laid. Statement G shows the average outturn of the two early plots of each type and similarly the average outturn of the two late ones. Statement H gives the average outturns of all the four plots of each type ; the average outturns of the standard (Punjab 11) plots on either side, and the differences in outturns between the types tested and the standard as indicated by the standard plot.

From the last statement it will be seen that the net result of these trials is that cross No. 3 tops the list with 1 maund 25 seers of grain per acre more than Punjab 11 ; 8-A comes next with 1 maund 9½ seers in excess of Punjab 11 and Punjab 11 beats all others, *i.e.*, stands 3rd in the list ; Pusa 12 has given 4 maunds 12½ seers of grain per acre less than Punjab 11.

Crosses.—One hundered and twenty selected crosses were tested on long narrow 1/32 acre area plots interstripped at intervals with similar plots of Punjab IX as a standard. Many of these have given excellent results (see statement I, page 26 to 29). Cross No. 3, which was in the F_2 generation in 1913, was also tested on the ⅛ acre plots mentioned in the preceding paragraph. It is an amber, moderately hard grained, bearded wheat, with a strong straw ; and it does not shed its grain easily during harvesting operations. In the 1/32 acre plot it has given 2 maunds 14 seers more than the estimated outturn of the standard on the same plot. Cross 3 was also on 3 acres of land lately handed over to us by the Jail Department, and it yielded 20 maunds 21 seers on one acre of poor land, and 40 maunds 2 seers per acre on the remaining 2 acres of much richer land, 3 irrigations being given after sowing. This cross was handed over to the Deputy Director of Agriculture, Gurdaspur, last year, and did very well there. A number of types of wheat were crossed in 1919 in the light of the results got, from our milling and baking tests, and from the outturns got in our plot tests. About 100 of the progeny were in the F_2 generation this year. They were sown in single rows on trenched land, on other land being available. At harvest time they had all fallen flat and got much mixed with one another so that plants for future sowings were isolated with great difficulty.

Australian wheats.—Seven types of Australian wheats were grown as usual on 1/32 acre plots for demonstration and crossing purposes (see statement J, page 30).

Note.—40 seers = 1 maund — 82 lbs. approximately.

GRAPH No. 1

RELATIVE HUMIDITIES AT 8 HOURS

L Y A L L P U R

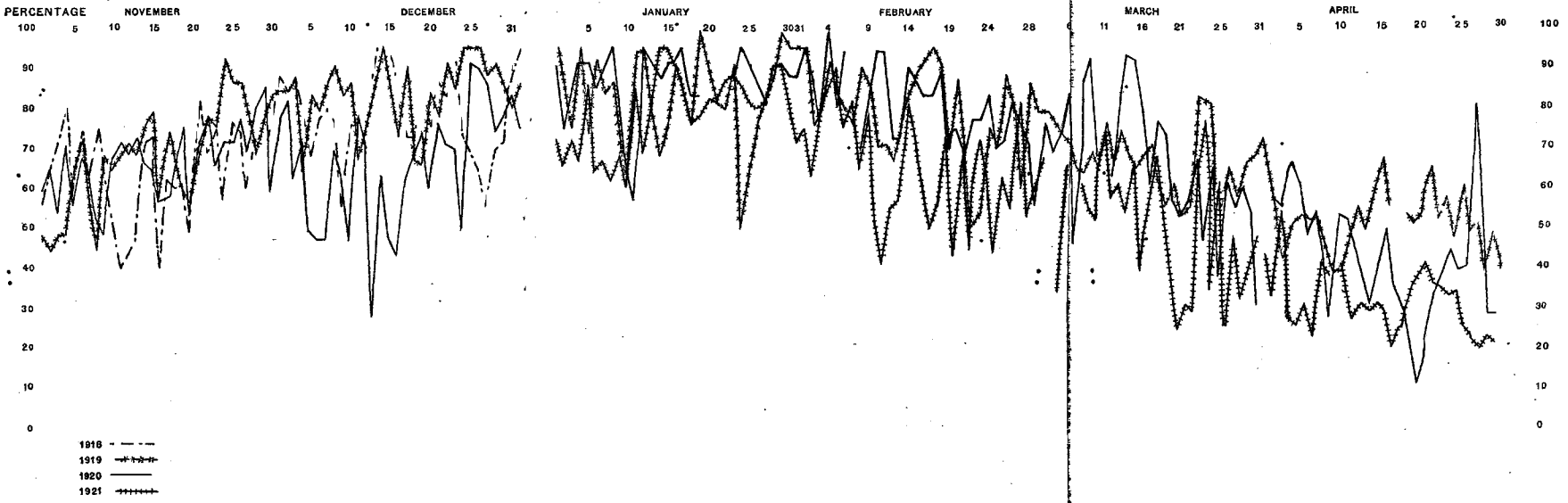


Photo.-Mechl. and Litho. Dept. Thomason College, Roorkee.

Zinco. November, 1920.—No.2202-200.

GRAPH No. 2

MAXIMUM AND MINIMUM TEMPERATURES.

LYALLPUR

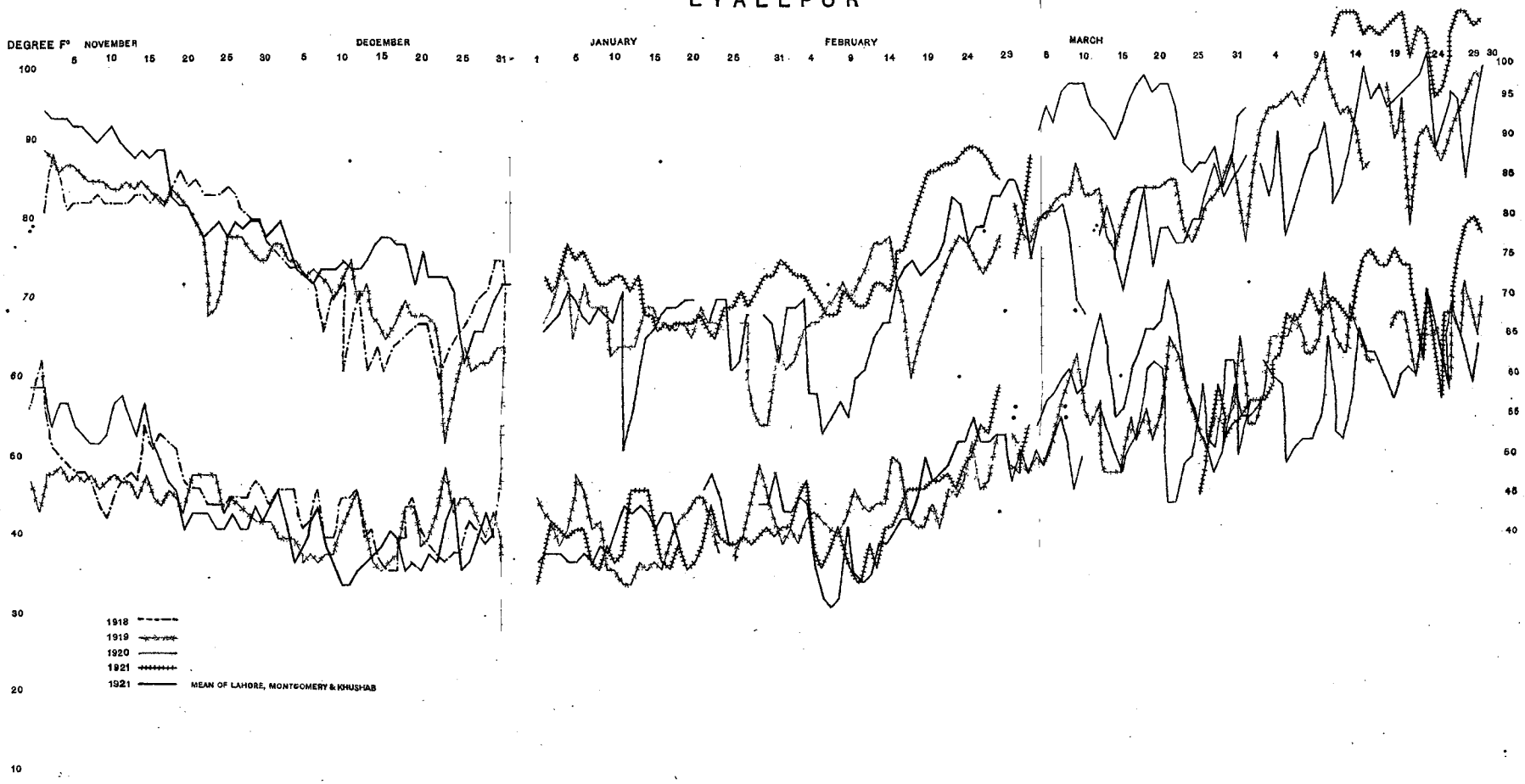


Photo.-Mechl. and Litho. Dept. Thomason College, Roorkee.

Zinco. October, 1921.—No. 3502-1.

Brief history of types under extended trial.—It is important from the point of view of economy of land and staff of the Agricultural Department to come to a decision as soon as possible regarding the relative merits of the types of wheat under extended trial, therefore we may give a brief history of the work connected with them.

Punjab 9, Punjab 17, and Punjab 11 were among the first batch of wheats handed over from the Botanical Section to the Agricultural Farm, Lyallpur, to enable the Professor of Agriculture to start final testing work on pure types, and we particularly recommended these three wheats to the Professor of Agriculture's notice ; type No. 9 because it appeared to be a very heavy cropper, the crop standing upright when all other common wheats had fallen flat, and the grain having very high Nitrogen content ; type No. 17 because it also appeared a very heavy cropper and had a splendid grain although inclined to shed its grains too freely during harvesting, and being beardless was apt to be attacked by birds, etc. ; type No. 11 because although a poorer cropper than either of the other two, it appeared a hardier wheat for general farming. The continuation of our experiments has borne these points out and given us a lot more information about these wheats. Of the three types, Punjab 11 has been most favoured for general purposes.

In the year 1910 however, we discovered type, 8-A in a sheaf got from Ferozepore and in our trials with it since that year it has consistently given better outturns both of grain and of straw than Punjab 11 where conditions were comparable ; also it has a better quality of grain ; is quite as hardy a type, and is more suitable in several ways for general farming than Punjab 11 is. At first of course we had it on very small plots as we had raised it from a single head, but after three years we got it on 1/32 acre plots, which give us useful information, and in later years its area has gradually increased.

The statements given below show the results of trials of 8-A, Punjab 11 and Pusa 12 for the past 5 years in square No. 31 of the Botanical Farm :—

Results of tests of 8-A with Punjab 11 as standard.

1	2	3	4	5	6	7	8	9
Year.	Serial No. of test.	Area of each plot, in acres	Punjab 11. Punjab 8 A. Punjab 11.			Average outturn of standard (Punjab 11).		Difference from standard.		Remarks.
			Outturn per acre.		*Outturn per acre.*		*Outturn per acre.*				
			Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	
1916-17 ...	1	¼	21	16	26	26	18	28	20	2	+ 6	24	
	2	¼	20	0	18	12	15	8	17	24	+ 0	28	
1917-18 ...	1	¼	9	20	10	20	14	0	11	30	— 1	10	Comparatively poor soil under 8-A which was attacked by white ants. White ants also attacked Punjab 11 on one plot.
	2	¼	22	4	26	8	19	4	20	24	+ 5	24	
1918-19 ...	1	¼	30	32	32	36	30	28	30	30	+ 2	6	
	2	¼	19	4	16	20	18	20	18	32	— 2	12	8-A was badly attacked by white ants, land being poor, sandy in patches.
1919-20 ...	1	⅛	26	0	32	6	30	30	28	15	+ 3	31	
	2	⅛	27	18	32	18	30	12	28	35	+ 3	23	
	3	⅛	34	24	33	30	29	34	32	9	+ 1	21	
	4	⅛	32	24	31	20	34	28	33	26	— 2	6	Thin stand of 8-A for want of water.
1920-21 ...	1	⅛	30	32	31	32	28	16	29	24	+ 2	8	
	2	⅛	28	16	29	32	28	16	28	18	+ 1	16	
	3	⅛	24	32	27	8	27	24	26	8	+ 1	0	
	4	⅛	33	8	32	16	30	36	32	2	× 0	14	

It will be seen that in 11 of the 14 tests 8-A yields more grain than Punjab 11, and in the remaining three there were factors in favour of reducing the odds against 8-A. Taking all the results into our calculation however, the average for each year is as follows :—

In 1916-17	8-A	beats	Punjab	11	by	3 maunds	26 seers.
„ 1917-18	8-A	„	„	11	by	2 „	7 „
„ 1918-19	Punjab 11	„	8-A		by	0 maund	3 „
„ 1919-20	8-A	„	Punjab	11	by	1 „	27 „
„ 1920-21	8-A	„	„	11	by	1 „	9 „

Therefore in four years out of the five 8-A yields more grain per acre than Punjab 11 and on the average of the five years 8-A yields 1 maund 29 seers of grain more per acre than Punjab 11.

Results of tests of Pusa 12 with Punjab 11 as standard.

1	2	3	4		5		6		7		8		9
Year.	Serial No. of tests.	Area of each plot in acres.	Punjab 11. *Outturn per acre.*		Pusa 12. *Outturn per acre.*		Punjab 11. *Outturn per acre.*		Average outturn of standard (Punjab 11).		Difference from standard.		Remarks.
			Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	
1916-17 ...	1	¼	21	16	28	32	...	...	21	16	+ 2	16	
	2	¼	20	0	18	24	...	...	20	0	— 1	16	
1917-18 ...	1	¼	15	4	15	4	9	20	12	12	+ 2	32	Comparatively poor land under Punjab 11.
	2	¼	19	4	15	0	13	8	16	6	— 1	6	
1918-19 ...	1	¼	31	32	28	20	27	28	30	30	— 2	10	
	2	¼	27	12	23	12	22	20	24	36	— 1	24	
1919-20 ...	1	⅛	29	14	28	24	24	38	27	6	+ 1	18	Thin stand of Punjab 11.
	2	⅛	29	18	27	12	26	16	27	36	— 0	24	
	3	⅛	28	36	27	36	30	36	29	36	— 2	0	
	4	⅛	33	2	31	34	34	2	33	22	— 1	28	
1920-21 ...	1	⅛	27	24	21	8	26	4	26	34	— 5	26	
	2	⅛	24	28	21	20	25	8	24	38	— 3	18	
	3	⅛	30	28	30	0	21	28	26	8	+ 3	32	Punjab 11 suffered for want of water, its land being higher.
	4	⅛	28	36	24	12	29	24	29	10	— 4	36	

Here, in 14 tests, Pusa 12 yields less than Punjab 11 in ten cases, and in the remaining 4 cases there were factors in favour of reducing the odds against Punjab 11. Again however, taking all the results into our calculations the average for each year is as follows—

In 1916-17	Pusa 12	beats	Punjab	11	by	20 seers.	
„ 1917-18	„ 12	„	„	11	„	33 „	
„ 1918-19	Punjab 11	„	Pusa	12	„	1 maund 37 seers.	
„ 1919-20	„ 11	„	„	12	„	28 seers.	
„ 1920-21	„ 11	„	„	12	„	2 maunds 22 seers.	

Therefore Punjab 11 yields more grain per acre in 3 out of the 5 years, and on the average for the five years Punjab 11 yields 31 seers per acre more than Pusa 12.

It will be noticed that in striking the average outturn for the five years I have ignored the areas on which the wheats were grown. It seems advisable to do this for several reasons; for example it is obvious that if a type was grown on 50 acres for one year in which the season was favourable to it, farmers would not get the same results if they grew it on one acre of average land with average cultivation for 50 years. I have shown the areas of the

plots, the outturns of the standard on either side, and the number of tests the above statement, however to show something of the conditions under which these results were got. There are several other factors, which greatly affect the accuracy of the results. Some of these cannot be easily shown on paper nor will they be detected and their influence accurately allowed for unless those in charge have a very intimate knowledge of wheats and wheat growing. We cannot alter the character of the soil on which we have to test our wheats, but if we make allowances for variations in this and for other disturbing factors we feel that the above difference in favour of 8-A is maintained.

Trials of the Lyallpur Agricultural Farm.—The Professor of Agriculture has been growing 8A and Punjab 11 side by side for the past five years. A summary of the grain yields recorded are given below.—

Tests in square No. 26.

In 1916-17 8-A yields more grain per acre than Punjab 11 by 38 seers.

„ 1917-18 8-A „ „ „ „ „ „ „ „ „ 34 „

„ 1918-19 8-A „ „ „ „ „ „ „ „ „ 35 „

„ 1919-20 Punjab 11 yields more grain per acre than 8-A by 1 maund 11 seers.

Therefore 8-A yields more grain in three out of the four years and on the average for the four years 8-A yields more grain than Punjab 11 by 14 seers per acre.

Square No. 26 is the oldest square for wheat and cotton testing purposes under direct cultivation on the farm.

Tests in square No. 43.

In 1917-18 8-A yields more grain per acre than Punjab 11 by 4 maunds 11 seers,

„ 1918-19 Punjab 11 yields more grain per acre than 8-A by 1 maund 23 seers,

and on the average for the two years 8-A yields more grain per acre than Punjab 11 by 1 maund 14 seers.

Tests on square No. 32.

In 1919-20 Punjab 11 yields more grain per acre than 8-A by 12 seers,

„ 1920-21 8-A „ „ „ „ „ „ Punjab 11 by 7 seers,

and on the average of the two years Punjab 11 yields more grain per acre than 8-A by 2½ seers.

Therefore simply taking the outturn figures given, the results of the trials made on land under the direct cultivation of the farm are in favour of 8-A.

Trials of 8-A and Punjab 11 on Tenants' area of the Farm.

In 1916-17 8-A yields more grain per acre than Punjab 11 by 1 maund 27 seers.

„ 1917-18 8-A „ „ „ „ „ „ „ „ „ 3 seers.

„ 1918-19 Punjab 11 yields more grain per acre than 8-A „ 1 maund 3 seers.

„ 1919-20 „ „ „ „ „ „ „ „ „ 11 seers.

„ 1920-21 „ „ „ „ „ „ „ „ „ 13 „

Here Punjab 11 beats 8-A in three of the five years, but on the average of the five years 8-A yields more grain than Punjab 11 by half a seer. For many reasons however the tests on the land under direct cultivation of the farm should be more reliable than those under tenants' cultivation.

Pusa 12 was tested at the Lyallpur Agricultural Farm and it was decided that it was a worse cropper than Punjab 11.

Trials at the Hansi Agricultural Station.—At the Hansi Agricultural Station, Punjab 11, 8-A and Pusa 12 have been grown for the past four years alongside some other wheats with Punjab 14 in every alternate bed as a standard, Punjab 14 being the most common wheat there. The outturns of grain given were as follows :—

Trials of 8-A and Punjab 14.

In 1917-18 8-A yields more grain per acre than Punjab 14 by 1 maund 38 seers

„ 1918-19 8-A „ „ „ „ „ „ „ „ „ 5 maunds 7 „

„ 1919-20 8-A „ „ „ „ „ „ „ „ „ 2 maunds 21 „

and „ 1920-21 8-A „ „ „ „ „ „ „ „ „ 3 maunds 2 „

i. e., in all four years 8-A gives more grain per acre than Punjab 14, and on the average of the four years 8-A gives 3 maunds and 7 seers more per acre than Punjab 14.

Trials of Punjab 11 and Punjab 14.

In 1917-18 Punjab 11 yields more grain per acre than Punjab 14 by 2 maunds 31 seers
„ 1918-19 „ „ „ „ „ „ „ „ „ „ „ 1 maund 28 „
„ 1919-20 „ „ „ „ „ „ „ „ „ „ „ 2 maunds 6 „
and „ 1920-21 „ „ „ „ „ „ „ „ „ „ „ 1 maund 20 „

i. e., in all four years Punjab 11 yields more grain than Punjab 14 and on the average of the four years Punjab 11 yields more than Punjab 14 by 2 maunds and 1 seer per acre.

Trials of Pusa 12 and Punjab 14.

In 1917-18 Pusa 12 yields more grain per acre than Punjab 14 by 15 seers
„ 1918-19 Punjab 14 „ „ „ „ „ „ Pusa 12 „ 8 maunds 20 seers
„ 1919-20 „ „ „ „ „ „ „ „ „ „ „ 3 „ 11 „
and „ 1920-21 Pusa 12 „ „ „ „ „ „ Punjab 14 „ 38 seers.

Therefore in two of the four years Punjab 14 beats Pusa 12 and on the average of the four years Punjab 14 yields 2 maunds 24 seers per acre more than Pusa 12.

Trials at Sargodha Seed Farm.—Types 8-A, Punjab 11 and Pusa 12 have been grown at the Sargodha Seed Farm for the past four years.

In 1917-18 Punjab 11 was used as the standard and in the following three years 8-A was the standard. We may also mention that in 1917-18 and 1918-19 the standard plots could not be threshed separately for want of labour They were therefore threshed collectively.

The differences in outturns of grain are as follows :—

In 1917-18 8-A yields more grain per acre than Punjab 11 by 2 maunds 38 seers
and Punjab 11 „ „ „ „ „ „ Pusa 12 „ 2 „ 39 „

In the 1918-19 early sowings 8-A yields more grain per acre than Punjab 11 by 1 maund 10 seers, and 8-A yields more grain per acre than Pusa 12 by 3 maunds 31 seers.

In the late sowings 8-A yields more grain per acre than Punjab 11 by 5 maunds 18 seers, and Pusa 12 yields more grain per acre than 8-A by 6 maunds 13 seers.

In the 1919-20 early sowings 8-A yields more grain per acre than Punjab 11 by 2 maunds 5 seers, and than Pusa 12 by 1 maund 3 seers.

In the late sowings 8-A yields more grain per acre than Punjab 11 by 9 seers and Pusa 12 yields more grain per acre than 8-A by 2 maunds 39 seers.

The 1920-21 report of the Deputy Director concerned is not yet to hand.

The result of these Sargodha trials is that 8-A yields more grain per acre than Punjab 11 in each of the three years' trials, and on the average of these years yields more than Punjab 11 by 2 maunds 19 seers per acre. Pusa 12 yields more than 8-A in two out of the three years, but on the average 8-A yields 1 maund 9 seers more grain per acre than Pusa 12. Looking over the trials of 8-A and Pusa 12 we find two very abnormal cases, and if they are omitted the wheats stand in the following order as regards yields of grain *viz.* 8-A, Punjab 11 and Pusa 12.

Trials on the Gurdaspur Agricultural Station.—For the past 5 years 8-A, Punjab 11 and Pusa 12 have been grown on land irrigated by wells.

8-A versus *Pusa 12* (*irrigated*).

In 1916-17 8-A yields more grain per acre than Pusa 12 by 7 maunds 12 seers
„ 1917-18 Pusa 12 „ „ „ „ „ „ 8 A „ 1 maund 9 „
„ 1918-19 8-A „ „ „ „ „ „ Pusa 12 „ 2 maunds 15 „
„ 1919-20 8-A „ „ „ „ „ „ Pusa 12 „ 2 „ 11 „
„ 1920-21 (Deputy Director of Agriculture's report not to hand).

Therefore 8-A yields more grain than Pusa 12 in 3 out of the 4 years, and on the average 8-A yields 2 maunds 27 seers per acre more than Pusa 12. In 1916-17 Pusa 12 was used as standard in the above tests, and 8-A in the remaining years.

8-A versus *Punjab 11* (*irrigated*).

These wheats have only been grown together for 3 years, *viz.*, 1917-18, 1918-19 and 1920-21, and the Deputy Director of Agriculture's report for 1920-21 is not to hand.

DIAGRAM SHOWING QUALITY OF SOIL IN COTTON PLOTS
IN SQUARE №28 & 46.

10 ACRE BLOCK

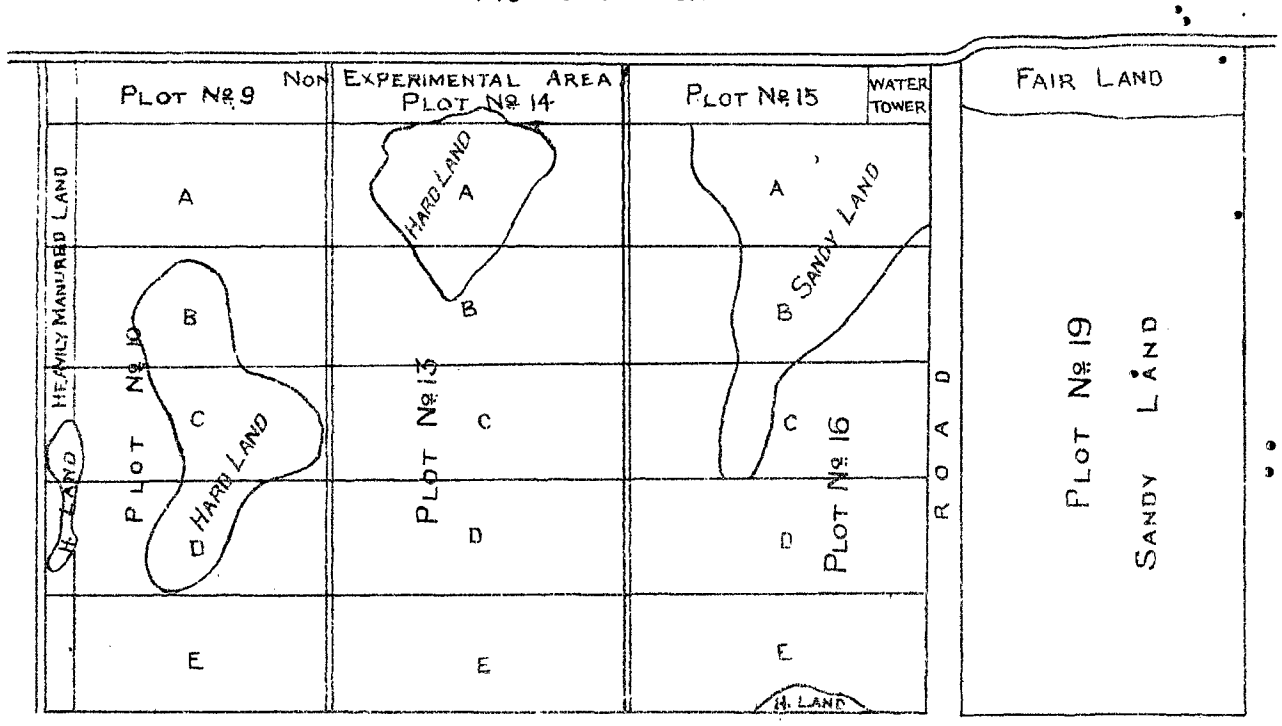
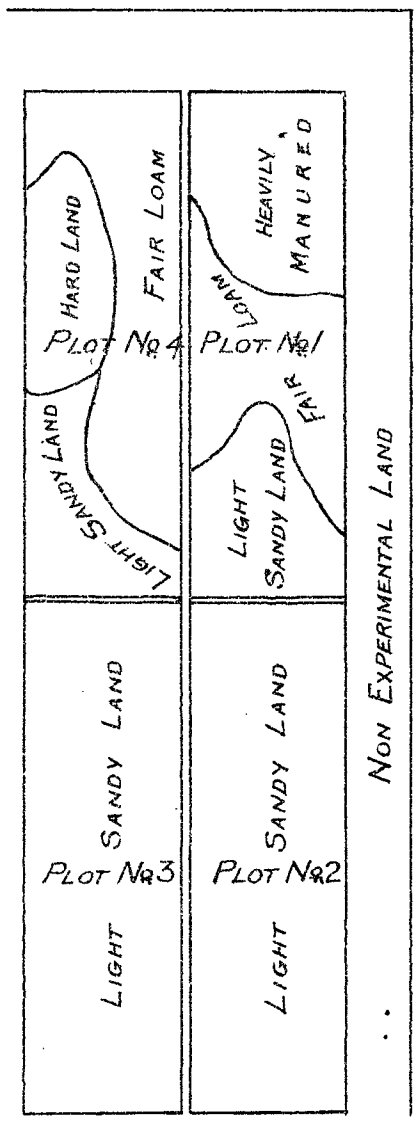


DIAGRAM SHOWING QUALITY OF SOIL IN COTTON PLOTS OF SQUARE 31.

EIGHT ACRE BLOCK



The differences in outturns for the two years reported on are as follows :—

In 1917-18 8-A yields more grain per acre than Punjab 11 by 5 maunds 30 seers.

„ 1918-19 8-A „ „ „ „ „ „ „ 4 „ 3 „

On the average of these two years 8-A yields more grain per acre than Punjab 11 by 4 maunds 36 seers.

On Barani lands (watered by rainfall) Punjab 14 was used as the standard against 8-A and Pusa 12 in all the years under report.

8-A versus *Punjab 14 (rainfall)*.

In 1916-17 Punjab 14 yields more grain per acre than 8-A by 1 maund 35 seers.

„ 1917-18 „ „ „ „ „ „ „ „ 0 „ 37 „

„ 1918-19 8-A „ „ „ „ Punjab 14 by 1 „ 14 „

„ 1919-20 8-A „ „ „ „ „ „ by 1 „ 33 „

„ 1920-21 (Deputy Director of Agriculture's report not to hand).

Therefore 8-A yields more grain per acre than Punjab 14 in two of the four years, and on the average of the four years 8-A yields more than Punjab 14 by 4 seers only.

Punjab 14 versus *Pusa* 12 (*rainfall*).

In 1916-17 Pusa 12 yields more grain per acre than Punjab 14 by 22 seers.

„ 1917-18 Punjab 14 „ „ „ „ „ Pusa 12 „ 30 „

„ 1918-19 „ „ „ „ „ „ „ „ „ „ 20 „

„ 1919-20 „ „ „ „ „ „ „ 2 maunds 2 seers.

„ 1920-21 (Report not to hand).

Here Punjab 14 yields more than Pusa 12 in three out of the four years' trials and on the average of the four years' yields 17 seers per acre more than Pusa 12.

General remarks regarding trials of 8-A Punjab 11 and Pusa 12.—Looking back over the results of all these trials it seems to me that as regards cropping powers the three wheats 8-A, Punjab 11 and Pusa 12, stand in the order just named. I am, however, only too well aware of the dangers of taking figures of outturns of different plots without the multitude of other factors which may have affected them into consideration, but those are the only data that I can give here, and as Punjab 11 has now been in our hands since 1918, and 8-A since 1910 I think that some conclusion regarding their relative merits should be made as early as possible.

District Survey of Wheats.—A survey of the wheat crop in Karnal District was made with the object of discovering the types of wheat grown in different parts of the district, their relative proportions, the conditions under which they are grown, etc., etc. Similar surveys have been made in other districts in previous years and have given useful information.

"Ear Cockle" disease in Wheat.—During the wheat survey carried out last year in Karnal District a large portion of the crop was found infected with "Ear Cockle" disease (Tylenchus scandens). The damage done by the disease in the Panipat Tahsil alone during the season under report was estimated at over a lakh of rupees, and there is little doubt that similar damage is done by it to the wheat crop of this locality year after year. The farmers believe that there is no cure for it, but our work on this disease for a number of years back has definitely shown that we can raise a clean wheat crop on any previously infected field, simply by sowing clean grain ; therefore that farmers can free their fields of it in a single year at practically no expense to themselves. It is hoped that plots of infected and clean wheats may be grown side by side at suitable centres in the infected localities to demonstrate the facts of the case to farmers.

Leaflets on the disease in Urdu and Gurmukhi will be distributed as soon as possible to those concerned.

Cottons.

Land.—Cottons grown on the botanical area occupied a total of 18 acres. Of this land, one block of ten acres consisted of plots Nos. 9, 10, 13, 14, 15 and 16 of square No. 28, and plot No. 19 of square No. 46 ; the remaining 8 acres, consisted of plots Nos. 1, 2, 3 and 4 of square No. 31.

The 10-acre block has sandy streaks running through it, and in places patches of hard land almost impenetrable by water (see diagram opposite).

We got the 8-acre block of land in 1915. It is mostly of a sandy nature. About $\frac{2}{5}$ths of plot No. 1 in this block had been heavily manured before we got it (see diagram opposite). In fact there is hardly a plot in either of these blocks which has soil of a fairly uniform character.

Sowings.—Desi and American cottons were grown interstripped over the whole of the 18 acres. On the 10-acre block they were sown on ridges 3 feet apart, and the areas of the plots were from single rows to $\frac{1}{8}$ acre each. On the 8-acre block they were sown in lines on the flat—American being 3 feet apart and the Desis 2½ feet apart—while the plots were each of $\frac{1}{2}$ an acre area. Altogether there were about 500 separate sowings of cottons including selections and crosses; about 400 being on small plots and 100 on larger ones. Of the latter, about half were Desi and half American. Practically all sowings were done in April.

Season.—The season was extremely dry and hot like the preceding one, which caused so much damage to the cotton crop.

The rainfall was only :—

1·25 inches in June,

0·49 inch in July,

3·17 inches in August,

1·53 „ in September,

and *nil* in October and November.

As regards humidities the readings at 8 A.M. were rather lower from early August to middle of September and slightly higher from then till the end of October than they were in 1919. Maximum temperatures from the end of July to the end of October were higher than in the same period of 1919.

On the whole the cotton season, like that of 1919, was an exceptionally severe one, and the effects on the cotton crop were much the same.

General condition of crop.—The majority of the flowers, flower-buds and young bolls were dropped by the cotton plants, both Desi and American, in the end of August, throughout September, and up to the middle of October. The opening of bolls was also affected and pickings were greatly delayed, also the lint especially from the American was of very inferior quality. There was no remarkable attack of boll worm or other disease.

Cottons in square No. 31.—The 8 acres of land in square No. 31 was laid out in 16 strips of half an acre each, Desi and American varieties of cottons occupying alternate strips (see statement K, pages 31, 32). The land was unfortunately at a higher level than the water from the irrigating channel can readily flow on to, therefore the area irrigated per hour was very small, and as we could only have our own turn of water, frequent irrigations were out of the question. Up to the end of October the plots as a rule got three to five waterings, *viz.*, plot No. 2 got one watering in June, one in September and one in October. Plot No. 4 got one watering in June, one in September and two in October, while plots Nos. 1 and 3 got one in June, one about the end of July, one in September and two in October.

In such dry years as the one under report the water-holding capacity of the soil is a big factor in the production of the crop, and we find that the outturns got run steadily parallel to the combination of the number of irrigations with this factor.

As was expected both American and Desi varieties suffered on the hard patch in plot No. 4. An interesting point was that in the part of plot No. 1, which had been excessively manured before we took over the land in 1915, the plants, both Desi and American, were undersized throughout the season, their bolls opened badly and they yielded very little crop while those on the unmanured portion grew to almost normal size, their bolls opened better and they yielded better. A combination of the excessively hot dry season and limited irrigation together with the excess of soluble salts in the soil was the cause of this.

Our highest outturns were from the Desi varieties Roseum No. 124 and Roseum No. 132 which gave over 10 maunds of kapas per acre, while the highest outturn from the American was from No. 285-F. which gave over 5 maunds of kapas per acre. The average outturn per acre from the 4 acres of Desi cottons was 8 maunds 4 seers of kapas, while that from the Americans was 3 maunds 31 seers. The quality of lint of the Americans, especially from the hard patches, was also more adversely affected by the season than those of the Desis.

Cottons in squares Nos. 28 *&* 46.—There were about 2½ acres of cottons in square No. 46. They were mostly single plants and crosses on very small beds. In square No. 28 there were about 7 acres of cotton—Desis and Americans interstripped in beds ranging from $\frac{1}{60}$th to $\frac{1}{8}$th acre each (see statement L, pages 33to 37.)

The soil as a rule was a fair loam of about 6 feet depth overlying almost clean sand. There were some small patches which were sandy right to the surface and some hard patches such as have been already described. On the latter neither Desis nor Americans did well. The plots got from five to eight waterings between the time of germination of the plants and the end of October (see statement L, pages 33 to 37.)

The outturns of kapas, both Americans and Desis, were about normal. The highest outturn of all the cottons grown on this square was got on trenched land from the American variety 72-F. which gave over 22 maunds of kapas per acre. Unfortunately part of the plot on which 285-F. was grown was hard land, but as usual it did extremely well considering the quality of the soil on which it grew. On the average of the plots of Desis and Americans,

where the quality of the land was fair and comparable, the Americans gave rather the better outturns. The lints of the Americans in these plots were also good. This further supports our old conclusion that—

(*a*) we have now American types which can stand the severest years of the Punjab climate and can produce a good quality of lint;

(*b*) will give a greater outturn of kapas than Desis on fair quality of loam with suitable cultivation and irrigation;

(*c*) Desi varieties will pay best on lighter soils with poorer cultivation and irrigation.

From our trials, the trials on the farm and from our district surveys we have also seen enough years ago to convince us that our selected Desi varieties are very much more profitable to farmers than unselected Desis.

I might also draw attention here to the fact that in rainy years on fair soils with fair cultivation American cottons will pay better than Desis, while on sandy soils with poor cultivation Desis will pay better than Americans. And in a very dry year on any soil Desis will pay better than Americans, unless they get more irrigations at critical times. In such seasons as 1919 and 1920, one or two waterings in August, two in September and two in October seem essential to ensure a good crop of American cotton.

Valuation of American Cottons.—One bale weighing 132lbs. of 285-F. grown on the Botanical area in 1919-20, and one bale weighing 399lbs. of 4-F. grown by farmers in the same year were sent to the British Cotton Growing Association Manchester, for valuation. The Association very kindly valued the cotton for us on 11th October 1920, and the gist of the report is as follows :—

(1) 285-F.—good colour, little leaf, grading barely good middling, American basis; staple silky and strong, full $1\frac{1}{8}$."

Value 22·50 pence per lb.

(2) 4-F.—good colour, leafy, fully good ordinary to low middling, American basis staple about 1" but irregular and mixed with shorts.

Value 13·00 pence per lb.

"285-F. of course is by far the best and is quite suitable for Lancashire users of American."

N. B.—Value of good Broach 14·10 pence per lb.

Value of middling American 17·74 pence per lb.

Value of good Oomra 12·50 pence per lb.

Twenty-nine samples of American cotton and 9 samples of Desi from the 1920-21 crops were sent to Messrs. R. D. Tata and Company, Bombay, for valuation. The firm kindly valued the samples for us about 27th July 1921. Regarding the Americans the best samples were 4 of 285-F. and 1 of 289-F. which spun 50*s*. and were valued at from Rs. 525 to Rs. 550 per candy (784 lbs.); 5 more, *viz.*, 138-F., 289-F., 292-F., 297-F., 286-F. spun 50*s*. and were valued from Rs. 500 to Rs. 525 per candy; 4 samples, *viz.*, 72-F., 286-F., 286(*a*)-F., and 296-F., spun 44*s*. the first of which was valued at Rs. 480, the second at Rs. 510 and the third and fourth at Rs. 500 per candy; 7 more samples spun 40*s*. and were valued at from Rs. 460 to Rs. 480 per candy.

Valuation of Desi Cottons.—Sanguineum No. 27 gave the best lint. It is reported to spin 10*s*. and is valued at Rs. 325 per candy. Three other Sanguineum samples are reported to spin from 6*s*. to 10*s*. and are valued from Rs. 300 to Rs. 320 per candy. A sample of G. Neglectum No. 109 is reported to spin 10*s*. and valued at Rs. 315. One of G. Indicum No. 38 is reported to spin 8*s*. and valued at Rs. 315.

Mollisonis Z and X, and Roseum 132 are reported to spin 6*s*. and valued at Rs. 300 per candy.

The basis on which the above valuations, both Americans and Desis, were fixed is as follows :—

Basis of valuation.

Sind American	...	...	...	...	Rs. 360
Fine Surat	...	...	...	...	„ 430
„ Navsari	...	...	...	...	„ 460
„ Broach	...	...	...	...	„ 360
„ Cambodia	...	...	...	...	„ 435
Middling (spot in Liverpool)		...	...	...	8·75*d*.
Fine Bengal	...	...	...	...	Rs. 310
„ Berar (new crop)	...	...	...	...	„ 340
„ Central Provinces	...	...	...	...	„ 375

Trials of 285-F. versus 4-F. outside the Botanical Farm.—Lieut. J. L. Flowerdew, officer in charge of the Military Farm, Okara, in his report, dated 24th February 1921, observed

that 285-F. beat 4-F. by about 1½ maunds per acre. He has grown it for the past two years and hopes to have 1,200 acres under 285-F. next year. The Extra Assistant Director of Agriculture, Montgomery, in his report, dated 17th July 1921, states that in the past year 100 acres were under 285-F. in his circle ; that it was reported to have done well everywhere, and that as a result over 1,600 acres have been sown this year.

The following are 10 reports to hand on the trial of 285-F. *versus* 4-F. by farmers in different chaks of the Lyallpur colony :—

Farmer No.	285-F. v. 4-F.		Remarks.
	4-F. outturn.	285-F. outturn.	
	Md. Srs. Chs.	Mds. Srs. Chs.	
No. 1 ...	2 17 4	3 10 0	Regards 285-F. as a better cotton.
„ 2 ...	2 9 3	5 2 8	Regards 285-F. as a better variety, easy in picking.
„ 3 ...	...	4 2 0	Very good.
„ 4 ...	...	3 11 0	Less yielder than 4-F., perhaps due to late sowing.
„ 5 ...	4 10 0	5 7 0	Appears to be a good cotton.
„ 6 ...	2 9 3	3 29 0	Better than 4-F.
„ 7 ...	6 21 4	6 21 4	Regards 285-F. as a good cotton.
„ 8 ...	1 31 14	3 19 0	Better than 4-F.
„ 9 ...	2 27 12	4 19 12	Ditto.
„ 10 ...	...	7 14 4	Ditto.

We hear that in Chak 232-R. B. where a farmer got seeds of 285-F. for one acre in 1918, most farmers are now growing only 285-F.

At Sargodha and Rohtak it appears to have done better than 4-F. although neither have done well.

The trials at the Agricultural Farm, Lyallpur, are believed to indicate that 285-F. does better than 4-F. on lighter soils with poor water supply, and that the balance is in favour of 4-F. on heavy land with plentiful water supply. The first point agrees with our own experience, but not the second.

Trials of our Desi selections on the Agricultural Farm, Lyallpur.—Trials of our Desi selections on the Agricultural Farm, Lyallpur, indicate that they are much better croppers than the ordinary unselected Desi cottons. But we have several on the Botanical Farm that promise still better.

Root Rot disease in Cotton.—Work on the Root Rot disease in Cotton is being continued.

District Survey of Cotton.—A survey of the cotton crop in Ludhiana District was made with the object of discovering the types of cottons grown in different parts of the district, their relative proportions, the conditions under which they are grown, etc. etc. Similar surveys have been made in other districts in previous years.

Grams.

Types under trial in the Botanical area.—The 26 types of Punjab grams isolated in 1914 were sown in $\frac{\text{sq. 46}}{\text{plot 25}}$. As usual they were in long narrow 1/32-acre plots interstripped with Punjab type No. 7 as a standard. Twenty more selections got from later collections of Punjab grams, and a few crosses were grown on plot 24 in the same square. The whole of these grams occupied an area of about 1½ acres.

Outturns and factors affecting them.—Common outturns of grain from the gram crop this year were 5 to 8 maunds, instead of our usual 20 to 30 maunds or more per acre. The miserable crop was due to the severity of the season (see rainfall figures on page 1 and in the statement on pape 13 also graphs of humidities and temperatures opposite page 2) combined with the poor sandy nature of the soil on which the grams were grown. Grams come into flower in early February, and ripen in April, therefore this period is a critical one for the crop. There had been practically no rains throughout the gram season and this together with the abnormally low humidities and high maximum temperatures during the gram flowering and fruiting period caused numerous flowers to fall from the plants and poor development of the seeds in many of the pods that were left on the plants.

PLAN A OF THE TYPES YPES OF GRAM SOWN ON 30 10/19

IN SQL/PL IN SQUARE 46/PLOT 25

Scale *Scale of Feet.*

Feet. 20 10 0 20 40 40 60 80 100 120 140 Feet.

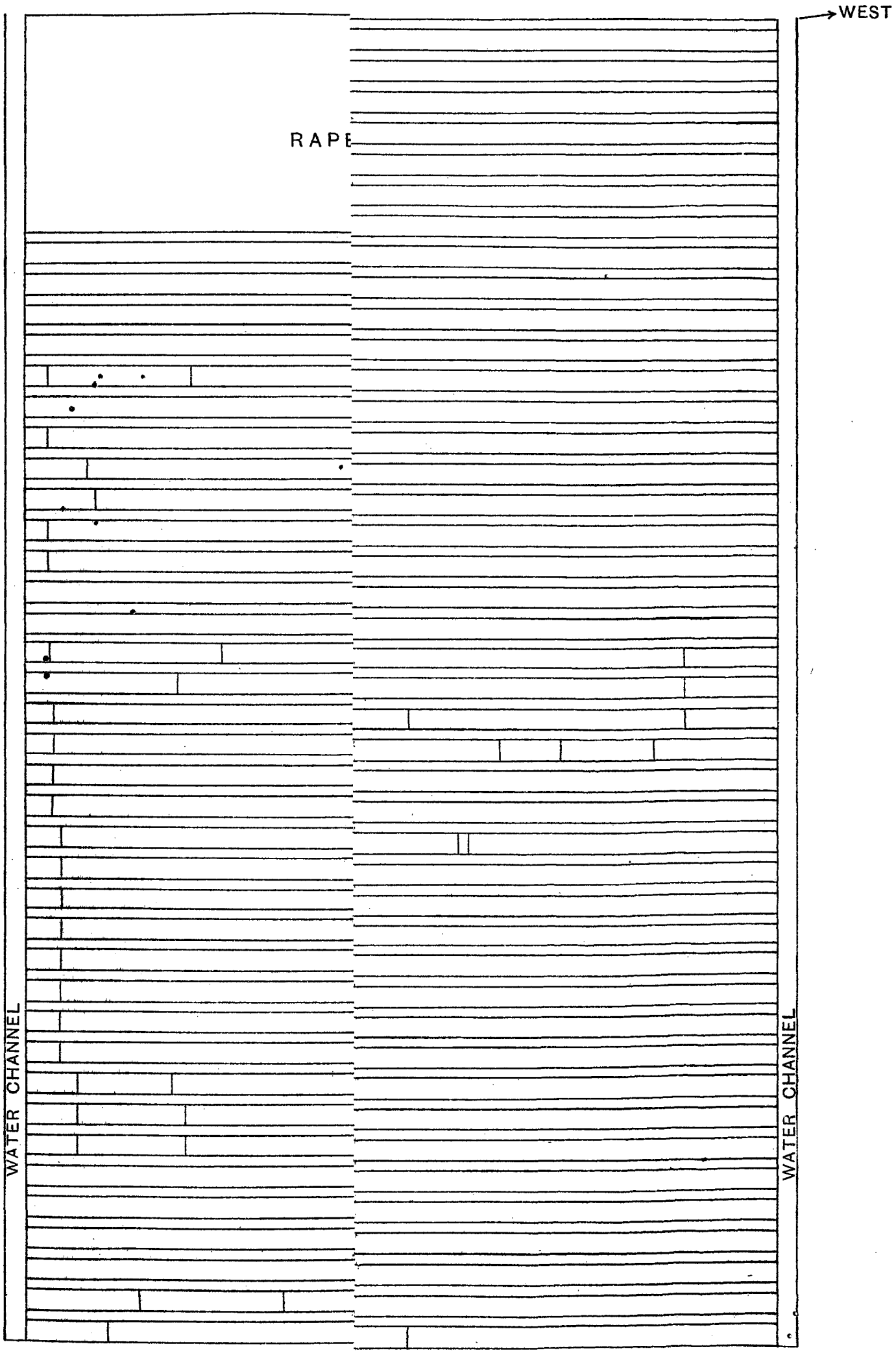


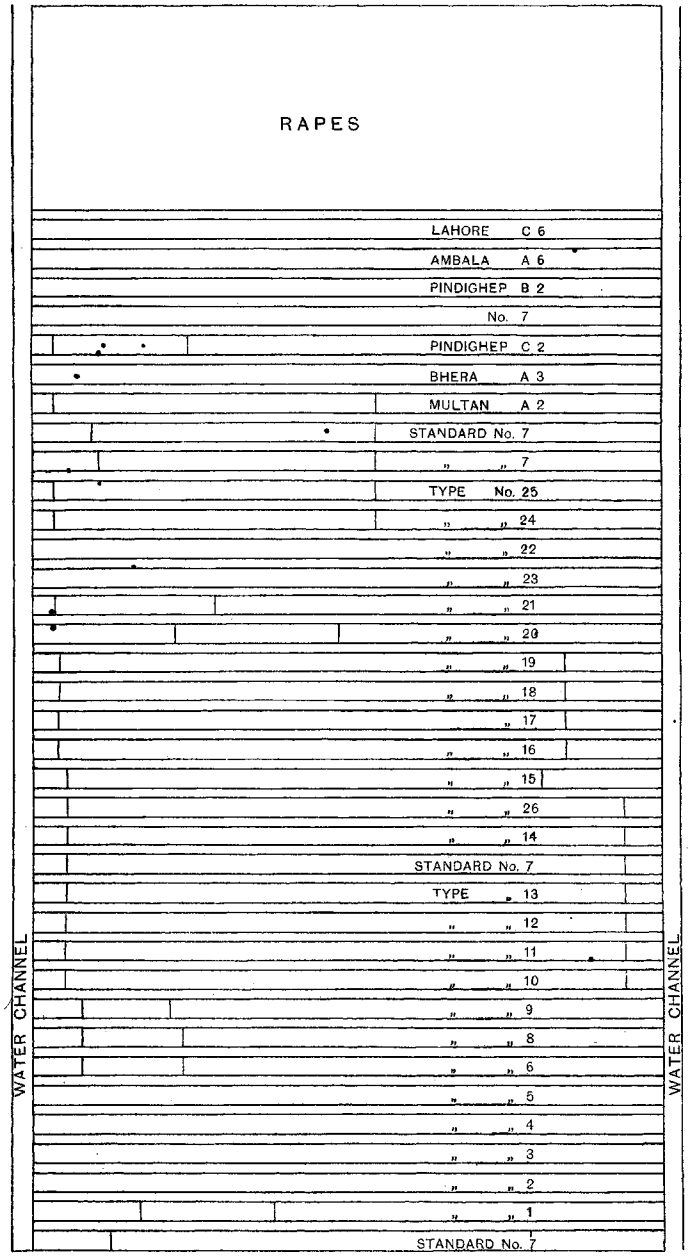
Photo. Zinco., November, 1921. No. 3502-2:500

PLAN A OF THE TYPES OF GRAM SOWN ON 24 10/18

IN SQUARE 46 / PLOT 25

Scale of Feet.

Feet. 20 10 0 20 40 60 80 100 120 140 Feet.



BED No. 3

BED No. 2

BED No. 1

BADLY ATTACKED BY WILT

MODERATELY ATTACKED BY WILT

PATHS—EACH 3' WIDE

PLAN B OF THE TYPES OF GRAM SOWN ON 30 10/19

IN SQUARE 46 / PLOT 25

Scale of Feet.

Feet. 20 10 0 20 40 60 80 100 120 140 Feet.

WEST

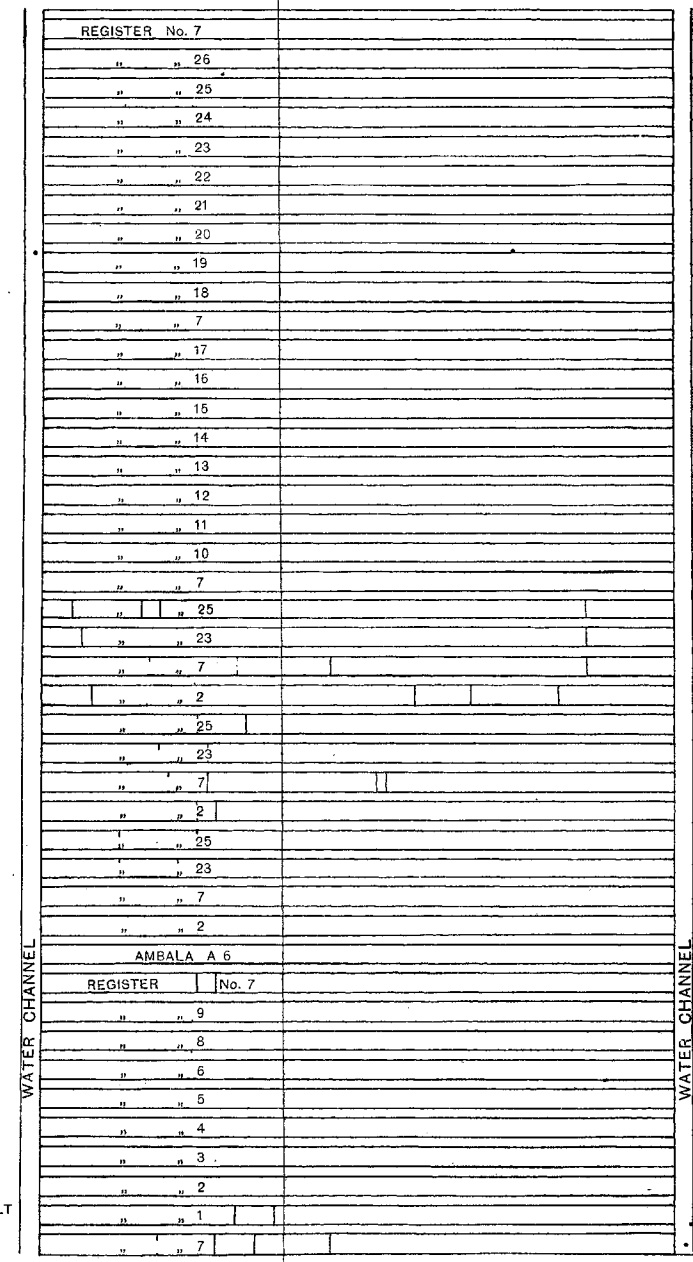


Photo. Zinco., November, 1921. No. 3502-2:500

PLAN C OF THE TYPES OF GRAM SOWN ON 28 10/20

IN SQUARE 46 / PLOT 25

Scale of Feet.

Feet. 20 10 0 20 40 60 80 100 120 140 Feet.

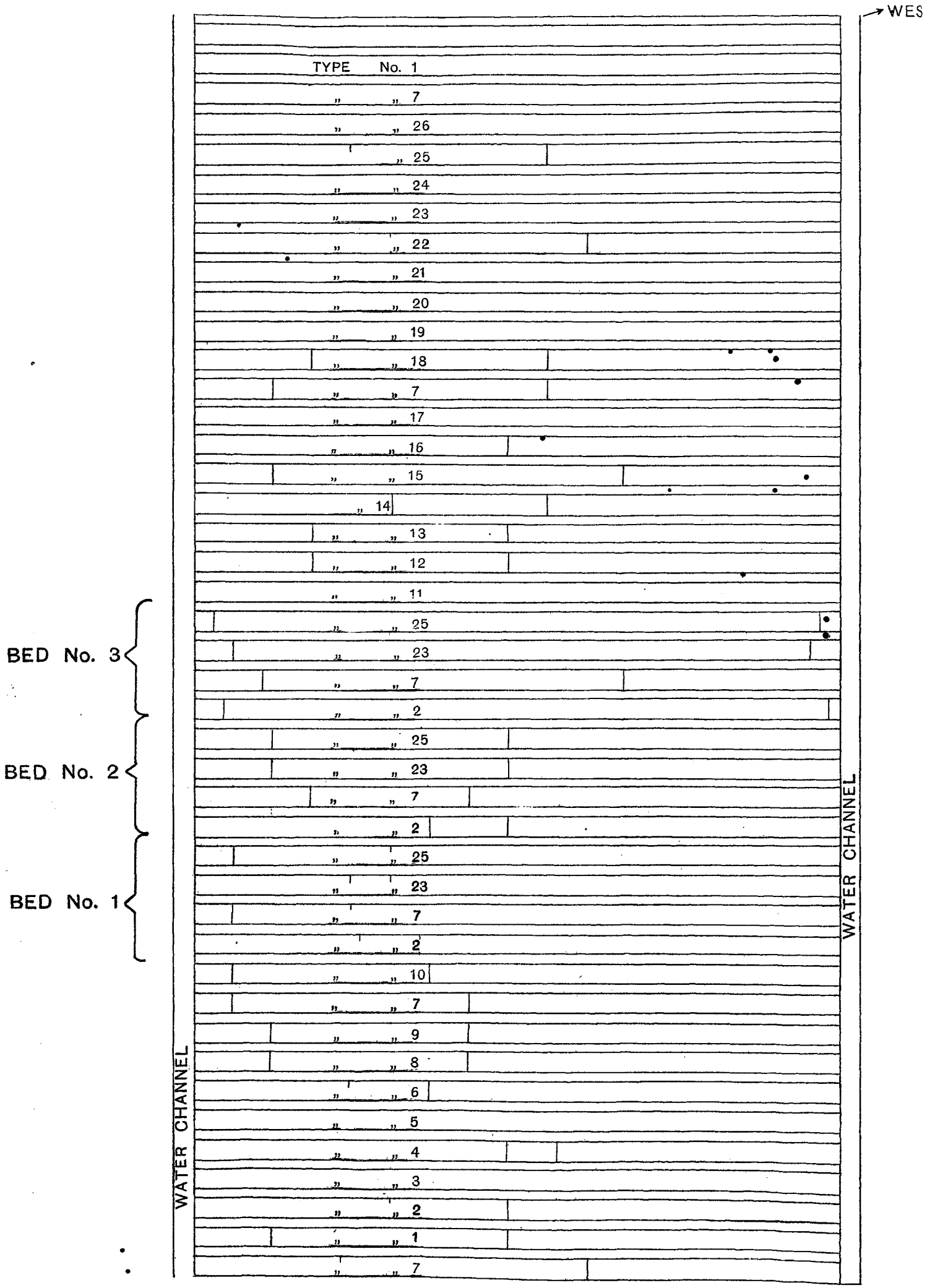


Photo. Zinco. November, 1921.—No. 3502-3×500

Gram wilt disease.—Our observations in past years had shown us—

(1) The disease was most marked in high-lying and sandy patches of affected areas.

(2) It tended to disappear alongside water channels and also where the crops were irrigated.

Want of water was therefore considered to be a large factor in the case. To throw some light on the above, the following line of work was adopted.

In 1918-19 various types of grams were sown as usual in long narrow strips of 1/32 acre, each interstripped at intervals with type No. 7 as a standard.

A plan of the area was made and the positions where the disease was worst were coloured dark green (see plan A opposite).

In the following year 1919-20 three beds were laid out for experiment in connection with the disease in a part of the plot including a good deal of the worst affected area. Four types of gram, *viz.* Nos. 2, 7, 23 and 25, were selected for sowing in these beds. The first two types are early, and the last two are late ripening. They also differ in habit, etc.

After the irrigation given in October, in order to prepare the seed bed for the grams,—

Bed No. (*i*) got 2 irrigations, *i.e.*, on 18th February1920 and 4th March 1920 ;
Bed No. (*ii*) got only one irrigation, *i.e.*, on 4th March 1920 ; and
Bed No. (*iii*) got no irrigation.

In this year we again made a plan of the area and coloured the most affected portions dark green and the less affected portions red (see plan B opposite).

In the next year, *i.e.*, 1920-21, the same beds were sown with the same types of gram.

Again after sowing—

Bed No. (*i*) got 2 irrigations, the 1st on 4th January 1921 and the 2nd on 1st February 1921,

Bed No. (*ii*) got one irrigation on 14th January 1921, and
Bed No. (*iii*) got no irrigation.
The plan was coloured as in the previous year.
(See plan C opposite.)

A brief statement showing the outturns of seeds per acre got from these experiments ; the irrigations given, and the rainfall between 1st November and 31st March for both years is given below :—

Gram wilt experiments.

Year.	Rainfall from 1st November to 31st March.		Gram variety.	Dates of irrigation given to each variety after sowing.			Outturn per acre of each variety.					
	Date.	Amount.		Bed No. 1.	Bed No. 2.	Bed No. 3.	Bed No. 1.		Bed No. 2.		Bed No. 3.	
			No.				Mds.	Srs.	Mds.	Srs.	Mds.	Srs.
1919-20.	23rd December	0·2	2	18th February 1920 and 4th March 1920.	4th March 1920 only.	Nil	19	24	22	16	14	32
	24th „	0 75										
	27th „	0·03										
	12th January	0·64										
	22nd „	0·02	7	Ditto	Ditto	Do.	24	32	28	16	20	0
	3rd February	0·14										
	4th „	0·07										
	7th March ...	0·05	23	Ditto	Ditto	Do.	17	8	15	24	9	24
	14th „ ...	0·26										
	18th „ ...	0·07										
	19th March ...	0·11	25	Ditto	Ditto	Do.	23	8	26	32	15	24
1920-21.	25th December	0·05	2	14th January 1921 and 1st February 1921.	14th January 1921 only.	Nil	11	8	10	16	2	0
			7	Ditto	Ditto	Do.	5	24	7	24	3	8
	17th January	0·09	23	Ditto	Ditto	Do.	12	0	1	8	1	3
			25	Ditto	Ditto	Do.	12	32	5	24	2	0

The outstanding features of the case so far are :—

(1) The disease appears about the flowering time of the crop.

(2) Its attack is most severe in the non-irrigated plots and least in those which are twice irrigated.

(3) The disease seems to follow the outlines of the varieties in the beds very closely ; therefore the characters of different types of gram combined with the conditions of soil and the irrigations given seem to be the factors delineating the diseased areas.

(4) Water supply in the soil seems to be an important factor. Even in the case of the beds which got no irrigation, there is practically no disease near the water channel which passes the ends of these beds and which flows frequently.

(5) The wilt disease seems to have got into the plants about flowering time, only when they were in a very dry condition or when affected by frosts in January.

(6) In the year 1920-21 which was very dry the attack was worse than in 1919-20 which was a far less dry year (see graphs of humidities and temperatures opposite page 2 and the statement on page 14).

Apparently 1920-21 was so dry that two irrigations did not meet the requirements of the crop as adequately as one watering did in the damper year of 1919-20. In fact bed No. 3 that got no irrigation in 1919-20 gave on the whole better outturns of grain than bed No. 1 did with two irrigations in 1920-21 (*vide* statement on page 13).

The nett result of all the evidence to hand seems to be that the disease only attacks the crop when the plants are weakened by unfavourable environment.

Some points of practical importance noticed up to date are :—

(1) The wilt disease is not carried from year to year by gram seeds.

(2) A sufficient supply of water to the plant during the flowering and fruiting season would probably save the crop from the disease.

(3) One irrigation in early March combined with the rainfall and humidity of the atmosphere in 1919-20 seems to have been quite sufficient for the gram crop, but even two irrigations have not been sufficient for the crop in 1920-21. Further work in connection with the gram wilt disease is being carried on.

Types under trial at the Agricultural Farms.—Four types, *i. e*, Nos. 7, 15, 17 and 20, have been tried by the Professor of Agriculture, Punjab, Lyallpur, at the Agricultural Farm for the past three years. The data supplied by him are given in the statement below :—

Statement showing the comparative tests of local and Economic Botanist's grams Nos. 7, 15, 17 and 20 for the years 1918-19, 1919-20 and 1920-21 on the Agricultural Farm, Lyallpur.

Year.	Square and plot.	Variety.	Area of each plot.	Total area under each variety.	Average outturns per acre. Grain.	Sown on	Number of irrigation and dates.	Remarks.
			K. M.	K. M.	Mds. Srs. Chks.			
1918-19	16 / 13	Local grams	1 19	8 0	17 27 0	25-10-18	One ; 31-3-19	
		Type No. 17	1 19	1 19	17 5 6	Do.	Do.	
		„ „ 20	1 19	1 19	13 1 0	Do.	Do.	Gram wilt was present here.
	17 / 23	„ „ 7	2 1	2 1	24 23 7	12-10-18	One ; 18-3-19	
		„ „ 15	2 1	2 1	14 9 12	Do.	Ditto	Badly attacked by gram wilt ; also suffered in ¼ acre owing to high land saline in nature.

Statement showing the comparative test of local and Economic Botanists grams Nos. 7, 15, 17 and 20 for the year 1918-19, 1919-20 and 1920-21 on the Agricultural Farm, Lyallpur.—concld.

Year.	Square and plot.	Variety.	Area of each plot.	Total area under each variety.	Average outturns per Acre. Grain.	Sown on	Number of irrigation and dates.	Remarks.
			K. M.	K. M.	Mds. Srs. Chks.			
1919-20	19 — 1 & 6 — 4	Local grams	1 8 and 2 4	7 5	21 21 4	21-10-19	One; 7-3-20	Germination good. Crop good, except one poor plot the land of which is poor.
		Type No. 7	1 8 and 2 4	7 5	22 2 3	18-10-19	One, 29-2-20	Ditto ditto.
	19 — 12	Local grams	1 12 and 1 15	3 7	21 24 7	Ditto	Ditto	Germination good. Crop good. One plot suffered through treading of people.
	Do.	Type No. 15	1 15	3 10	23 3 7	Ditto	Ditto	Germination good. Crop good.
	16 — 22	Local grams	2 1¼	4 2½	22 28 9	Ditto	One; 6-3-20	Germination good. Stand good.
	Do.	Type No. 17	2 1¼	4 2½	23 39 0	Ditto	Ditto	Ditto ditto.
	17 — 21	Local grams	2 1¼	4 2½	30 23 12	Ditto	One; 8-3-20	Ditto ditto.
	Do.	Type No. 20	2 1¼	4 2½	30 36 2	Ditto	Ditto	Germination good Stand good except a Kallar patch of 3 marlas in a plot.
1920-21	7 — 17	Local grams	2 3	4 6	16 10 3	5-10-20	Two; 20-1-21 and 19-3-21	Germination good. Crop good in one plot a little middle part unlevelled.
		Type No. 15	2 3	4 6	19 15 13	Ditto	Ditto	Germination good. Crop good.
	5 — 10 — 2 & 13 — 18	Local grams	1 2 and 0 19¼	6 1	15 4 4	25-10-20	One; 20-1-21	Germination good. Crop good. In two plots there was thin and irregular germination on one side.
		Type No. 7	1 2 and 0 19¼	6 1	14 19 3	Ditto	Two; 19-1-21 and 7-3-21	Germination good. Crop good to average. In one plot there was thin stand at some places.
	13 — 15	Local grams	0 19½	3 18	11 14 5	13-10-20	Two; 19-1-21 and 7-3-21	Germination good. Crop average.
		Type No. 20	0 19½	3 18	12 26 10	Ditto	Ditto ...	Germination good. Crop fairly good.
	16 — 23	Local grams	1 2	4 8	13 8 10	14-10-20	Two; 20-1-21 and 6-3-21	Germination good. Crop fairly good.
		Type No. 17	1 2	4 8	14 2 4	Ditto	Ditto ...	Ditto
	26 — A	Local grams	2 0	8 0	9 20 8	9-10-20	One; 16-1-21	Previous crop here was chari and guara.
		Type No. 15	2 0	8 0	6 38 0	Ditto	Ditto	Ditto ditto.

N. B.—20 marlas = 1 kanal = ⅛ acre.

The outstanding points seem to be—

(1) In the year 1918-19 type No. 7 stood at the top yielding about seven maunds per acre more than the local. Type No. 17 also appears to have done well but the remaining two types, *i.e.*, Nos. 15 and 20, were reported to have been attacked by gram wilt, etc. Consequently their yields are low.

(2) In 1919-20 all the four types did better than the local gram against which they were tried.

(3) In 1920-21 three of the types 15, 17 and 20 have done better than the local in the main experiment.

In another test, *viz*, in $\frac{\text{square } 26}{\text{plot A}}$ both the local gram and type 15 have done so miserably that the results cannot be a measure of the cropping power of either. Indeed all the outturns for the year 1920-21 are low. No. 7 yields about 25 seers less than the local. For some curious reason type No. 7 seems to have got a watering on the 7th of March while the local tried against it got none. Probably something had gone wrong with the plots, and if so the results are not comparable.

On the whole however the tests at the farm during the three years that these gram types have been tried seem to indicate that the types handed over by us are better than the local.

The same four types have been tried by the Deputy Director of Agriculture, Gurdaspur, for the past three years. The data given to us are as follows :—

Type.	Outturn per acre.					
	Year 1918-19		Year 1919-20		Year 1920-21	
	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.
Local ...	26	6	10	6	16	7
7 ...	24	15	12	28	11	31
15 ...	27	14	12	18	14	37
17 ...	27	13	14	17	17	17
20 ...	24	13	11	39	17	17

We are informed that although the local variety was interstripped with these as a standard, the crops from the standard plots were collected and thrashed in one heap. This of course prevents us from judging differences in quality of soil in the different plots from the outturns of standards growing alongside of them. No. 17 has however yielded more than the average outturns from the standard plots of local grams each year.

At Sargodha also the same four types have been tried.

Nos. 7 and 17 did better than local grams in the 1st year. In the 2nd year the stands of the crop were so uneven that no useful comparison of outturns could be made ; while this year the outturns range from about 2½ to 8 maunds per acre, and are too miserable to indicate relative cropping powers. No. 7 however has given the highest yield.

The same types have also been grown at the Hansi Farm for the last three years. The data given to us seem very erratic and the outturns on the whole miserable. The Deputy Director of Agriculture, Hansi, informs us that the lands are too uneven to give reliable data.

Barleys.

Season.—Common barleys come in flower from the middle to the end of February ; their grains are full sized and well stored with milk by the middle of March and they are ripe in the beginning of April ; therefore the remarks on page 1 regarding the wheat season apply approximately to barleys.

Types under trial at Lyallpur and their results.—Two types of English barley, a Punjab cross and 16 natural types of Punjab barleys which were isolated from the mixtures of types collected by us from different districts of the Punjab a number of years ago, were grown as usual interstripped with local barley as a standard. The area occupied by these experiments was about one acre. The statement M, on page 38, shows the outturns, etc., got. Outturns from three very recently discovered Punjab types are not included, as they were grown on single lines. It will be noticed that cross $\frac{N}{R}$ tops the list with 42 maunds per acre, and type No. IV (Re.) comes out with 41 maunds 24 seers per acre.

Types being tried by Deputy Director of Agriculture, Hansi, and their results — Last year four types of barleys, *viz.*, Nos. I (Ly.) II (Mu.), IV (Re.), V (Ly. E) were tested in Gurgaon District, the chief barley-growing tract of the Province, by the Deputy Director of Agriculture, Hansi, and he reported as follows :—

" Four varieties were obtained from the Economic Botanist, Punjab, and were grown side by side with local barley at three different places in the district of Gurgaon. Type No. IV (Re.) has done best and is also an early ripening variety. The results at our own farm are also in favour of this type."

From the information given to us by the Deputy Director of Agriculture, Hansi, this year the same type tops the list in each of the three places where he made the tests. Details of the outturns are shown in the following statement:—

Type No.	Outturn per acre got from the fields at					
	Chandarnagar		Jarsa.		Daulatpur.	
	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.
I (Ly.) ...	15	14	9	7	10	22
II (Mu.) ...	25	27	10	8	11	32
IV (Re.) ...	30	18	10	32	12	8
V (Ly. E.) ...	22	12	7	8	11	16
Local ...	22	32	9	7	11	24

Type No. IV (Re.) again stands first at each place and the order in which the other types stand as regards outturns of grain seems very consistent. The average results of the above experiments are as follows:—

Name of variety.	*Outturn per acre.*	
	Mds.	Srs.
No. IV (Re.)	17	33
No. II (Mu.)	15	36
Local	14	21
No. V (Ly. E.)	13	25
No. I (Ly.)	11	28

These results indicate that type No. IV (Re.) is likely to spread in the south-eastern tract of the Province.

Oats.

A certain amount of work has been done on oats for a number of years back, but we have had little staff and time to devote to this crop. It is important however in connection with the fodder question which is occupying the minds of farmers so very much. A number of varieties of Scotch and French oats have been tried against the local Desi oats as regards their suitabilities for fodder purposes. The following is a brief statement of results for the year under report :—

Name of variety.	Area.	Dates of			Outturn per acre			
					Grain.		*Bhusa.*	
		Sowing	Earing.	Ripening.	Maunds.	Seers.	Maunds.	Seers.
Propslier, from Scotland	1 — 32	18th October 1920	28th March 1921	31st May 1921	7	24	81	24
Yielder "	"	Ditto	18th March 1921	Ditto	11	8	97	24
Victory " ...	"	Ditto	28th March 1921	Ditto	9	24	92	32
Gold reins " ...	"	Ditto	Ditto	Ditto	10	0	99	8
Potato " ...	"	Ditto	Ditto	Ditto	9	8	100	0
Sandy " ...	"	Ditto	Ditto	Ditto	6	16	80	0
Huskless French	"	Ditto	Ditto	Ditto	2	0	97	24
Husked " ...	"	Ditto	Ditto	Ditto	5	8	92	32
Desi oats ...	"	Ditto	3rd February 1921.	24th March 1921	30	16	62	16
	"							

It will be seen that on the whole the Scotch and French oats provide green fodder up to about the end of April, whereas the Desi only provides green fodder up to early March. Also that the weight of Bhusa yielded by the exotic varities is about 1½ times as much as is yielded by the Desi oats. Green fodder is extremely scarce in April and these exotic varieties are useful in this respect. The demand for seeds of these is gradually increasing.

POTATOES.

Experiments with potatoes were carried out in the Simla hills at the following places :—

(*a*) Pataingli } near Mashobra.
(*b*) Dhani }
(*c*) Kufri.
(*d*) Domahr near Fagu.
(*e*) Pinhortu near Matiana.

The varieties experimented with were Scotch types Nos. 3, 6, 11, 17, 18 and 19 grown interstripped with the local Simla hill variety. The total area under experiment was about 4 acres. The season at the above places was fairly normal, tending to be a little too dry for the crop in shaley lands, especially at the lower altitudes. As usual, in past years the Scotch potatoes have again done much better than the local potatoes in all the experimental fields. At four farms where these experiments were carried out, and the season was not too severe, the average outturns of crop got from fields in which nothing abnormal could be detected were as follows :—

	Scotch Potatoes.			Local Potato.		
	Outturns.			*Outturns.*		
	In multiples of seed planted.	Per acre.		In multiples of seed planted.	Per acre.	
		Mds.	Srs.		Mds.	Srs.
Farm A ...	10·8	167	39	5·7	87	27
Do. B ...	7·4	112	37	4·4	59	8
Do. C ...	9·8	136	26	5·6	73	23
Do. D ...	7·7	81	28	5·2	58	18
Average of A, B, C & D.	8·9	124	30	5·2	69	29

Taking the average outturn figures from the above, the Scotch potatoes yield 55 maunds 1 seer per acre more than the local potatoes. The price of potatoes per maund in the field during the time when we lifted most of our potatoes (15th September to 4th October) was about Rs. 3-12-0 (data supplied by the Tahsildar, Simla), therefore by growing Scotch potatoes instead of local varieties these growers had a clear profit of 55 × Rs. 3-12-0, *i.e.*, Rs. 206 per acre approximately, the expenses on cultivation, etc., being practically the same in both cases. Of the crop harvested, we reserved 114 maunds for future experiments and distributed another 114 maunds to various people, chiefly in the Simla hills.

I may mention that for a number of years back, farmers around these experimental plots have been getting seed-tubers from us, and crops of local potatoes are now difficult to find in these vicinities. People much further afield have also got small quantities of tubers from us from time to time. The demand for these Scotch potatoes is always far greater than the supply. Indeed the crop has always been booked up by the time it has been planted.

We have now another 21 varieties which we have ourselves raised from true seeds and crosses. 13 of them are now in their third year, and some are promising well. Two years ago we started some experiments on potatoes at Sialkot in answer to a request for this. One of the growers at Sialkot after seeing these experiments has asked for at least 200 maunds of tubers of Scotch type No. III. Reports on the Sialkot experiments have already been sent to the Director of Agriculture, Punjab.

A note giving a more full account of potatoes work carried on by us was sent to the Director of Agriculture, Punjab, with my demi-official letter dated 4th July 1921.

Date Palms.

The season was favourable to date-farming. Rains at the ripening time of fruits (20th July to 20th August) often do great damage, and there were practically no rains at that time in the past year. In the Arabian date plantation started in 1910 in the Taleri Bagh, Muzaffargarh, 200 trees bore fruits and in the Muzaffargarh Memorial Hall plantation put down in the same year 40 Arabian trees bore fruits. A total crop of 23 maunds 33 seers of cured fruits were got from these 240 trees. Fruits of first class quality were sold at Re. 0-8-0 per lb. packed in cardboard boxes, and the rest at rates varying from Re. 0-5-0 to about Re. 0-2-6 per lb. The gross income was Rs. 580.

The 2 acres of Arabian date plants planted in the Date Farm, Muzaffargarh, in the years 1918 and 1919 are doing well. We now have a tube well giving a discharge of about $\frac{1}{4}$ cusec of water. The Farm is situated alongside the Taleri District Board Garden, and the Deputy Commissioner is now asking if water from the well can be supplied to that garden. The possibility of this tube well being called upon to irrigate the Taleri Bagh was in our minds while designing the well and deciding its site. By working the well for longer hours we hope to be able to meet the Deputy Commissioner's request. There is a necessity for a pumping plant for short water lifts in many parts of the district, and our tube well is attracting a good deal of attention.

The results got from the Arabian date plantation have created among farmers an increasing demand for some years back for more date suckers to be brought from Mesopotamia. Conditions in Mesopotamia have been very unsettled since 1914, however, and suckers could not be imported, but last year in compliance with the demand and in consultation with the political authorities in Mesopotamia, and shipping agents, an attempt was made to import some young trees. The first assistant to the Economic Botanist was sent to Mesopotamia for a supply, but owing to unrest involving shipping difficulties which arose, the attempt was not very successful. However we were able to procure and distribute to Punjab farmers 3,811 trees which although late in arriving were in good condition. We also got 1,859 trees for our own gardens, but they were not only late in arriving but arrived in poor condition owing to shipping delays.

"Red Rot" in sugarcane.

Experiments with Red Rot disease (Colletotrichum falcatum) on sugarcane were continued on the same lines as in the previous year. Where sets reddened by the disease were planted, 72% of the resulting crop was destroyed by the disease: and where apparently healthy sets got from an infected field were planted 45% of the crop was destroyed by the disease. Imported clean canes grown interstripped with diseased canes for two years gave a crop, the market value of which was not reduced by the disease. On a very few of the canes however infection was noticed, and if the infected canes were planted the disease would gradually spread in the clean crop.

In attempts to find a variety of cane free from the disease and suitable for the Ferozepore District, a number of varieties were grown. These included "Striped Maritius" got from the Agricultural Farm, Gurdaspur, and a number of other varieties got from the Government Sugarcane Expert, Coimbatore. The Striped Maritius variety appears promising but further trials are necessary to confirm our results.

It was observed that 'Red Rot' caused heavy losses to the thick-cane crop at Dharmkot in Zira Tahsil, Ferozepore District. Undoubtedly the damage done by this disease to the thick cane crop of the district is great, and our work up to date shows that something can be done to check this damage.

Some three thousand copies of our leaflet on "Red Rot" disease have been issued to zamindars in Ferozepore and other districts.

Other Crops.

Work on oil-seeds, maize and other crops is handicapped for want of staff.

Acknowledgment.—My warmest thanks are due to the staff, one and all, for their assistance in attempts to do something of practical value for the province. This in many cases necessitates getting beyond the known point a matter—as history everywhere bears out—is only apparently easy after the discovery has been made, thoroughly understood and demonstrated so that any one may see it. Also steady application to work and something of the spirit of unselfishness is needed, for problems which are of most immediate practical value to the province are by no means always those which would pay the worker best to take up.

D. MILNE.

Statement A.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. *Grain.* Maunds.	*Grain.* Seers.	*Bhusa.* Maunds.	*Bhusa.* Seers.	Outturn equivalent to 100 marks. Maunds.	Outturn equivalent to 100 marks. Seers.	Marks obtained by each type.	Remarks.
IX (Standard) ...			14th November 1920.	11th March 1921.	23rd April 1921.	23	8	50	16	31	0	100	Border: ¼ crop dried up altogether for want of water.
IV A			Ditto	10th March 1921.	23rd April 1921.	31	8	52	0	31	21	98	
VIII A ...			Ditto	12th March 1921.	22nd April 1921.	37	24	61	24	32	2	117	
VIII B ...			Ditto	7th March 1921.	17th April 1921.	31	8	58	16	32	23	96	
VIII C ...			Ditto	10th March 1921.	20th April 1921.	32	0	60	32	33	4	97	$\frac{1}{11}$th crop lodged on 31st March 1921.
IX (Standard) ...			Ditto	12th March 1921.	23rd April 1921.	33	24	72	32	33	24	100	
IX A			Ditto	11th March 1921.	22nd April 1921.	32	16	59	24	33	2	98	
IX B ...			Ditto	12th March 1921.	22nd April 1921.	30	0	62	0	32	20	92	
IX C ...			Ditto	8th March 1921.	17th April 1921.	32	16	49	8	31	38	101	
XVI A ...			Ditto	8th March 1921.	17th April 1921.	28	0	45	24	31	16	89	
IX (Standard) ...			Ditto	12th March 1921	23rd April 1921.	30	32	61	8	30	32	100	
XVII A ...	18	1	Ditto	7th March 1921.	17th April 1921.	31	8	47	8	29	31	105	
XVII B ...	46	32	Ditto	7th March 1921.	17th April 1921.	30	0	49	8	28	30	104	
XVII C ...			Ditto	9th March 1921.	16th April 1921.	28	32	48	32	27	29	104	
XVIII A ...			Ditto	10th March 1921.	19th April 1921	26	32	41	8	26	28	100	
IX (Standard) ...			Ditto	11th March 1921.	23rd April 1921.	25	24	53	24	25	24	100	
XVIII B ...			Ditto	9th March 1921.	19th April 1921.	28	0	48	32	25	21	110	
XIX A ...			Ditto	8th March 1921.	20th April 1921.	28	0	52	0	25	18	110	$\frac{1}{12}$th crop lodged on 31st March 1921.
XIX B ...			Ditto	9th March 1921.	17th April 1921.	27	32	45	32	25	15	110	$\frac{1}{11}$th crop lodged on 31st March 1921.
XIX C ...			Ditto	9th March 1921.	17th April 1921.	27	24	50	32	25	12	109	$\frac{1}{10}$th crop lodged on 31st March 1921.
IX (Standard) ...			Ditto	11th March 1921.	23rd April 1921.	25	8	53	8	25	8	100	
XIX D ...			Ditto	8th March 1921.	17th April 1921.	28	16	51	24	24	20	117	
XIX E ...			Ditto	11th March 1921.	18th April 1921.	30	0	51	24	23	12	128	
XIX F ...			Ditto	11th March 1921.	18th April 1921.	28	16	54	32	22	14	128	$\frac{1}{10}$th crop lodged on 31st March 1921.
XIX G ...			Ditto	10th March 1921.	17th April 1921.	24	32	44	0	21	16	116	

Statement A— CONCLUDED.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn equivalent to 100 marks. Maunds.	Outturn equivalent to 100 marks. Seers.	Marks obtained by each type.	Remarks.
IX (Standard) ...			14th November 1920.	11th March 1921.	23rd April 1921.	20	16	38	32	20	16	100	
XIX H ...			Ditto	10th March 1921.	18th April 1921.	21	8	36	32	20	32	102	
XIX I ...			Ditto	7th March 1921.	17th April 1921.	21	8	36	32	21	8	100	
XIX J ...			Ditto	10th March 1921.	18th April 1921.	19	8	54	16	21	24	89	
XIX K ...			Ditto	10th March 1921.	18th April 1921.	21	8	46	0	22	0	95	
IX (Standard) ...			Ditto	11th March 1921.	23rd April 1921.	22	16	55	8	22	16	100	
XX A ...			Ditto	9th March 1921.	19th April 1921.	29	32	46	32	22	35	117	
XX B ...			Ditto	9th March 1921.	17th April 1921.	28	0	41	24	23	14	120	
XX C ...			Ditto	10th March 1921.	18th April 1921.	30	0	53	8	23	33	126	
XX D ...			Ditto	7th March 1921.	18th April 1921.	22	16	43	8	24	12	92	$\frac{1}{6}$th crop lodged on 31st March 1921.
IX (Standard) ...	18	1	Ditto	12th March 1921.	23rd April 1921.	24	32	44	0	24	32	100	
XX E ...	46	32	Ditto	13th March 1921.	21st April 1921.	23	8	44	32	23	34	97	
XXIII A ...			Ditto	10th March 1921.	17th April 1921.	22	0	43	24	22	36	96	
XXIV A ...			Ditto	8th March 1921.	18th April 1921.	22	24	38	8	21	38	103	
XXIV B ...			Ditto	9th March 1921.	19th April 1921.	25	16	43	8	21	0	121	
IX (Standard) ...			Ditto	12th March 1921.	23rd April 1921.	20	0	52	32	20	0	100	
XXIV C ...			Ditto	7th March 1921.	17th April 1921.	22	24	47	0	20	0	113	$\frac{1}{10}$th crop lodged on 31st March 1921.
XXIV D ...			Ditto	10th March 1921.	17th April 1921.	28	16	62	32	33	32	87	$\frac{1}{10}$th crop lodged on 31st March 1921.
XXV A ...			Ditto	10th March 1921.	17th April 1921.	30	32	58	32	32	32	94	
XXV B ...			Ditto	10th March 1921.	17th April 1921.	33	24	59	8	32	32	102	
IX (Standard) ...			Ditto	12th March 1921.	23rd April 1921.	32	32	69	24	32	32	100	
XXV C ...			Ditto	10th March 1921.	17th April 1921.	30	0	48	16	32	13	93	

NOTE.—40 seers = 1 maund = 82 lbs. approx.

Statement B.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn equivalent to 100 marks. Maunds.	Outturn equivalent to 100 marks. Seers.	Marks obtained by each type.	Remarks.
Hoshiarpur, No. 1			14th November 1920.	6th March 1921.	17th April 1921	29	0	47	32	31	34	91	
„ „ 2			Ditto	7th March 1921.	Ditto	31	16	51	32	31	15	101	
„ „ 3			Ditto	11th March 1921.	Ditto	31	0	60	8	30	36	100	
Punjab, No. 9 (Standard).			Ditto	12th March 1921.	Ditto	30	16	64	0	30	16	100	
Hoshiarpur, No. 4			Ditto	10th March 1921.	19th April 1921.	32	0	68	32	29	30	108	
„ „ 5			Ditto	7th March 1921.	18th April 1921.	31	24	69	8	29	4	109	Whole crop bent down on 31st March 1921.
„ „ 6			Ditto	8th March 1921.	Ditto	35	8	72	32	28	18	124	Ditto ditto.
„ „ 7	18	1	Ditto	9th March 1921.	17th April 1921.	33	8	70	32	27	32	119	Ditto ditto.
Punjab, No. 9 (Standard).	46	32	Ditto	12th March 1921.	18th April 1921.	27	8	72	0	27	8	100	
Hoshiarpur, No. 8			Ditto	3rd March 1921.	22nd April 1921.	30	0	54	32	27	8	110	$\frac{1}{15}$th crop lodged on 31st March 1921.
„ „ 10			Ditto	9th March 1921.	17th April 1921.	28	16	50	0	27	8	104	
„ „ 11			Ditto	10th March 1921.	22nd April 1921.	28	0	56	0	27	8	103	
„ „ 12			Ditto	13th March 1921.	21st April 1921.	25	8	56	32	27	8	93	
„ „ 13			Ditto	10th March 1921.	19th April 1921.	28	32	48	0	27	8	106	$\frac{1}{12}$th crop lodged on 31st March 1921.
„ „ 16			Ditto	7th March 1921.	17th April 1921.	23	0	49	0	27	8	85	$\frac{1}{8}$th crop lodged on 31st March 1921.
Punjab, No. 9 (Standard).			16th November 1920.	11th March 1921.	23rd April 1921.	12	16	76	32	16	0	100	Border : $\frac{1}{4}$th crop dried up altogether for want of water. Whole crop lodged on 29th March 1921.
Red Chauntra ...			Ditto	2nd March 1921.	20th April 1921.	14	24	86	8	16	0	91	Whole crop lodged on 29th March 1921.
Gujrat D ...			Ditto	8th March 1921.	21st April 1921.	14	32	88	16	24	0	93	Ditto ditto.
„ E ...			Ditto	Ditto	20th April 1921.	20	0	71	8	24	0	83	Ditto ditto.
„ F ...			Ditto	9th March 1921.	21st April 1921.	22	0	93	8	24	0	92	Ditto ditto.
Punjab, No. 9 (Standard).			Ditto	11th March 1921.	23rd April 1921.	24	0	96	0	24	0	100	Ditto ditto.
Ferozepore, E ...			Ditto	4th March 1921.	21st April 1921.	28	0	77	24	24	22	114	Ditto ditto.
„ N ...			Ditto	8th March 1921.	Ditto	24	24	66	24	25	4	98	Ditto ditto.
Muzaffargarh, No. 1.			Ditto	Ditto	Ditto	24	8	75	0	25	26	94	Ditto ditto.
Muzaffargarh, No. 2.			Ditto	4th March 1921.	20th April 1921.	25	24	88	0	26	8	98	Ditto ditto.
Punjab, No. 9 (Standard).			Ditto	9th March 1921.	23rd April 1921.	26	32	82	0	23	32	100	Ditto ditto.
Muzaffargarh, No. 4.	4 &5	1	Ditto	3rd March 1921.	20th April 1921.	26	8	82	24	26	35	97	Ditto ditto.
Muzaffargarh, No. 5.	28	32	Ditto	8th March 1921.	Ditto	21	16	74	24	26	18	79	Ditto ditto.
Muzaffargarh, No. 6.			Ditto	Ditto	Ditto	23	24	93	8	27	1	87	Ditto ditto.
Muzaffargarh, No. 7.			Ditto	Ditto	Ditto	25	8	101	8	27	4	93	Ditto ditto.
Punjab No. 9 (Standard).			Ditto	10th March 1921.	23rd April 1921.	27	8	107	8	27	8	100	Ditto ditto.
Muzaffargarh, No. 8.			Ditto	9th March 1921.	21st April 1921.	26	32	75	24	27	27	97	Ditto ditto.
Muzaffargarh, No. 9.			Ditto	Ditto	22nd April 1921.	35	24	108	16	28	6	126	Ditto ditto.
Muzaffargarh, No. 10.			Ditto	8th March 1921.	20th April 1921.	30	24	99	0	28	25	107	Ditto ditto.
Muzaffargarh, No. 12.			Ditto	9th March 1921.	19th April 1921.	29	8	90	32	29	4	100	Ditto ditto.
Punjab, No. 9 (Standard).			Ditto	Ditto	22nd April 1921.	29	24	92	32	29	24	100	Ditto ditto.
Muzaffargarh, No. 13.			Ditto	10th March 1921.	20th April 1921	32	0	97	24	30	9	106	Ditto ditto.
Muzaffargarh, No 14.			Ditto	Ditto	Ditto	32	24	89	0	30	34	106	Ditto ditto.
Muzaffargarh, No. 15.			Ditto	8th March 1921.	Ditto	31	16	57	16	31	19	100	Ditto ditto.
Muzaffargarh, No. 16.			Ditto	10th March 1921.	Ditto	32	24	47	32	32	4	102	Ditto ditto.
Punjab, No. 9 (Standard).	17	1	Ditto	9th March 1921.	23rd April 1921.	32	32	90	16	32	32	100	Ditto ditto.
Rawalpindi, H ...	28	32	15th November 1920.	4th March 1921.	19th April 1921.	20	0	68	0	32	0	66	Whole crop lodged on 31st March 1921.

Statement C.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds	Bhusa. Seers.	Average of outturns of Standards (Punjab 11) in plots on either side. Maunds.	Seers.	Remarks.
Punjab 11 ...			26th October 1920	2nd March 1921	20th April 1921	30	32	48	16	...	...	
8-A ...			Ditto	5th March 1921	Ditto	31	32	53	16	29	24	
Punjab 11 ...			Ditto	2nd March 1921	Ditto	28	16	42	8	...	...	
8-B ...			Ditto	19th February 1921.	18th April 1921	22	32	40	16	28	2	
Punjab 11 ...			Ditto	2nd March 1921	20th April 1921	27	28	46	12	...	...	
9-C ...			Ditto	29th February 1921.	16th April 1921	23	4	44	12	27	26	
Punjab 11 ...			Ditto	2nd March 1921	20th April 1921	27	24	45	8	...	...	
Pusa 12 ...			Ditto	18th February 1921.	15th April 1921	21	8	38	24	26	34	
Punjab 11 ...	6/31	1/8	Ditto	2nd March 1921	20th April 1921	26	4	42	4	...	...	
16-A ...			Ditto	4th March 1921	17th April 1921	23	8	45	24	22	14	
Punjab 11 ...			Ditto	2nd March 1921	20th April 1921	18	24	33	16	...	.	The land being sandy crop was attacked by white ants.
17-B ...			Ditto	3rd March 1921	17th April 1921	17	20	36	12	21	28	Ditto dltto.
Punjab 11 ...			Ditto	Ditto	20th April 1921	24	32	42	32	...	...	
Cross 2 ...			Ditto	2nd March 1921	Ditto	18	32	34	16	22	10	The land being sandy crop was attacked by white ants.
Punjab 11 ...			Ditto	Ditto	Ditto	19	28	33	20	...	...	Ditto.
Cross 3 ...			Ditto	Ditto	Ditto	25	20	50	20	19	28	

Statement D.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds	Bhusa. Seers.	Average of outturns of Standards (Punjab 11) in plots on either side. Maunds.	Seers.	Remarks.
Punjab 11 ...			12th November 1920.	8th March 1921	20th April 1921	28	16	47	0	...	...	
8-A ...			Ditto	10th March 1921	Ditto	29	32	52	16	28	16	
Punjab 11 ...			Ditto	8th March 1921	Ditto	28	16	44	16	...	...	
8-B ...			Ditto	21st February 1921.	16th April 1921	21	0	34	0	27	18	
Punjab 11 ...			Ditto	8th March 1921	20th April 1921	26	20	40	36	...	...	
9-C ...			Ditto	29th February 1921.	16th April 1921	25	24	41	0	25	24	
Punjab 11 ...			Ditto	8th March 1921	20th April 1921	24	28	38	4	...	...	
Pusa 12 ...	7/31	1/8	Ditto	21st February 1921.	15th April 1921	21	20	32	28	24	38	
Punjab 11 ...			Ditto	8th March 1921	20th April 1921	25	8	37	8	...	...	
16-A ...			Ditto	9th March 1921	17th April 1921	23	24	39	8	25	28	
Punjab 11 ...			Ditto	8th March 1921	20th April 1921	26	8	39	16	...	...	
17-B ...			Ditto	Ditto	17th April 1921	23	32	40	32	28	20	
Punjab 11 ...			Ditto	Ditto	20th April 1921	30	32	46	8	...	...	
Cross 2 ...			Ditto	Ditto	Ditto	24	0	41	0	31	4	
Punjab 11 ...			Ditto	Ditto	Ditto	31	16	41	32	...	...	
Cross 3 ...			Ditto	9th March 1921	Ditto	31	4	50	28	31	16	

Statement E.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. *Grain.* Maunds.	*Grain.* Seers.	*Bhusa.* Maunds.	*Bhusa.* Seers.	Average of outturns of Standards (Punjab 11) in plots on either side. Maunds.	Seers.	Remarks.
Punjab 11 ...			27th October 1920.	3rd March 1921	20th April 1921	24	32	45	8	...	..	
8-A ...			Ditto	5th March 1921	Ditto	27	8	55	16	26	8	
Punjab 11 ...			Ditto	3rd March 1921	Ditto	27	24	48	0	...	...	
8-B ...			Ditto	19th February 1921.	16th April 1921	21	4	47	12	28	12	
Punjab 11 ...			Ditto	3rd March 1921	12th April 1921	29	0	44	0	...	...	
9-C ...			Ditto	27th February 1921.	16th April 1921	28	32	54	8	29	34	
Punjab 11 ...			Ditto	3rd March 1921	20th April 1921	30	28	54	20	...	...	
Pusa 12 ...			Ditto	16th February 1921.	15th April 1921	23	0	46	16	26	8	Thin stand of crop.
Punjab 11 ...	5/31	1/8	Ditto	3rd March 1921	20th April 1921	21	28	37	12	...	...	Land being higher crop suffered for want of water.
16-A ...			Ditto	4th March 1921	16th April 1921	21	28	38	36	24	6	Thin stand of crop.
Punjab 11 ...			Ditto	Ditto	20th April 1921	26	24	50	32	...	...	
17-B ...			Ditto	Ditto	17th April 1921	26	36	58	20	28	12	
Punjab 11 ...			Ditto	3rd March 1921	20th April 1921	30	0	58	0	...	...	
Cross 2 ...			Ditto	Ditto	Ditto	27	32	51	32	31	24	
Punjab 11 ...			Ditto	4th March 1921	Ditto	33	8	62	0	...	...	
Cross 3 ...			Ditto	3rd March 1921	Ditto	30	16	57	8	33	8	

Statement F.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. *Grain.* Maunds.	*Grain.* Seers.	*Bhusa.* Maunds.	*Bhusa.* Seers.	Average of outturns of Standards (Punjab 11) in plots on either side. Maunds.	Seers.	Remarks.
Punjab 11 ...			13th November 1920.	8th March 1921	20th April 1921	33	8	53	0	...	...	
8-A ...			Ditto	10th March 1921	Ditto	32	16	55	32	32	2	
Punjab 11 ...			Ditto	8th March 1921	Ditto	30	36	45	28	...	...	
8-B ...			Ditto	18th February 1921.	16th April 1921	25	8	43	16	30	6	
Punjab 11 ...			Ditto	8th March 1921	20th April 1921	29	16	46	16	...	...	
9-C ...			Ditto	29th February 1921.	16th April 1921	29	8	52	16	29	6	
Punjab 11 ...			Ditto	8th March 1921	20th April 1921	28	36	48	20	...	...	
Pusa 12 ...			Ditto	21st February 1921.	15th April 1921	24	12	48	20	29	10	
Punjab 11 ...	8/31	1/8	Ditto	8th March 1921	20th April 1921	29	24	52	8	...	...	
16-A ...			Ditto	Ditto	16th April 1921	26	0	54	8	27	28	
Punjab 11 ...			Ditto	7th March 1921	20th April 1921	25	32	49	16	...	...	
17-B ...			Ditto	Ditto	17th April 1921	25	24	52	16	24	20	
Punjab 11 ...			Ditto	8th March 1921	20th April 1921	23	8	51	32	...	...	Half of the crop suffered for want of water.
Cross 2 ...			Ditto	7th March 1921	Ditto	22	24	51	16	24	32	Ditto ditto.
Punjab 11 ...			Ditto	Ditto	Ditto	26	16	60	0	...	...	
Cross 3 ...			Ditto	8th March 1921	Ditto	30	8	65	24	26	16	

Statement G.

EARLY SOWINGS.								LATE SOWINGS.								
Type No. and its relative position.	Plot and square No.	Area in acres.	Date of sowing.	*Outturn per acre.* Maunds.	Seers.	*Average of outturns of Standards (Punjab 11) in plots on either side.* Maunds.	Seers.	Type No. and its relative position.	Plot and square No.	Area in acres.	Date of sowing.	*Outturn per acre.* Maunds.	Seers.	*Average of outturns of Standards (Punjab 11) in plots on either side.* Maunds.	Seers.	REMARKS.
Punjab 11 ...			26th-27th October 1920.	27	32	...	...	Punjab-11 ...			12th-13th November 1920.	30	32	...	...	
8-A ...			Ditto	29	20	27	36	8-A ...			Ditto	31	4	30	9	
Punjab 11 ...			Ditto	28	0	...	...	Punjab 11 ...			Ditto	29	26	...	...	
8-B ...			Ditto	21	38	28	7	8-B ...			Ditto	23	4	28	32	
Punjab 11 ...			Ditto	28	14	...	...	Punjab 11 ...			Ditto	27	38	...	...	
9-C ...			Ditto	25	38	28	30	9-C ...			Ditto	27	16	27	15	
Punjab 11 ...			Ditto	29	6	...	...	Punjab 11 ...			Ditto	26	32	...	...	
Pusa 12 ...	5 & 6	¼	Ditto	22	4	26	21	Pusa 12 ...	7 & 8	¼	Ditto	22	36	27	4	
Punjab 11 ...	31		Ditto	23	36	...	...	Punjab 11 ...	31		Ditto	27	16	...	...	
16-A ...			Ditto	22	18	23	10	16-A ...			Ditto	24	32	26	28	
Punjab 11 ...			Ditto	22	24	...	...	Punjab 11 ...			Ditto	26	0	...	...	
17-B ...			Ditto	22	8	25	0	17-B ...			Ditto	24	28	26	20	
Punjab 11 ...			Ditto	27	16	...	...	Punjab 11 ...			Ditto	27	0	...	...	
Cross 2 ...			Ditto	23	12	26	37	Cross 2 ...			Ditto	23	12	27	38	
Punjab 11 ...			Ditto	26	18	...	...	Punjab 11 ...			Ditto	28	36	...	...	
Cross 3 ...			Ditto	27	38	26	18	Cross 3 ...			Ditto	30	26	28	36	

Statement H.

Type No. and its relative position.	Plot and square No.	Area in acres (total of 4 plots of ¼ acre area each).	OUTTURN PER ACRE. Maunds.	Seers.	AVERAGE OF OUTTURNS OF STANDARDS (PUNJAB 11) IN PLOTS ON EITHER SIDE. Maunds.	Seers.	DIFFERENCE. Maunds.	Seers.	REMARKS.
Punjab 11			29	12	...	...	...	...	
8-A			30	12	29	2½	+ 1	9½	
Punjab 11			28	33	...	...	...	...	
8-B			22	21	28	19½	− 5	38½	
Punjab 11			28	6	...	...	...	...	
9-C			26	27	28	2½	− 1	15½	
Punjab 11			27	39	...	...	...	...	
Pusa 12	5, 6, 7 & 8	¼	22	20	26	32½	− 4	12½	
Punjab 11	31		25	26	...	...	...	...	
16-A			23	25	24	39	− 1	14	
Punjab 11			24	12	...	...	...	...	
17-B			23	18	25	36	− 2	12	
Punjab 11			27	8	...	...	...	...	
Cross 2			23	12	27	17½	− 4	5½	
Punjab 11			27	27	...	...	...	...	
Cross 3			29	12	27	27	+ 1	25	

Statement I.

CROSSES.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn equivalent to 100 marks. Maunds.	Outturn equivalent to 100 marks. Seers.	Marks obtained by each type.	Remarks.
IX (Standard) ...			30th October 1920.	6th March 1921.	23rd April 1921.	28	0	60	0	35	0	100	Borders ¼ crop dried up altogether for want of water. $\frac{1}{15}$th crop lodged on 1st March 1921.
1 ...			Ditto	3rd March 1921.	23rd April 1921.	33	16	57	32	35	30	93	$\frac{1}{15}$th crop lodged on 1st March 1921.
2 ...			Ditto	3rd March 1921.	22nd April 1921.	35	32	92	8	36	20	98	Ditto ditto.
3 ...			Ditto	3rd March 1921.	22nd April 1921.	39	24	84	16	37	10	106	Ditto ditto.
4 ...			Ditto	5th March 1921.	22nd April 1921.	33	8	94	32	38	0	88	Ditto ditto.
IX (Standard) ...			Ditto	6th March 1921.	23rd April 1921.	38	32	94	0	38	32	100	Ditto ditto.
5 ...			Ditto	10th March 1921.	21st April 1921.	34	16	73	24	38	10	90	Ditto ditto.
6 ...			Ditto	8th March 1921.	17th April 1921.	36	0	84	0	37	28	96	Ditto ditto.
7 ...			Ditto	5th March 1921.	22nd April 1921.	33	8	69	8	37	6	89	
8 ...			Ditto	4th March 1921.	22nd April 1921.	33	8	69	8	36	24	91	
IX (Standard) ...			Ditto	7th March 1921.	22nd April 1921	36	0	82	16	36	0	100	
9 ...			Ditto	9th March 1921.	22nd April 1921.	32	0	81	24	36	0	89	
10 ...			Ditto	1st March 1921.	17th April 1921.	31	24	50	0	36	0	88	
11 ...	11 1 / 28 32		Ditto	1st March 1921.	18th April 1921.	26	0	55	24	36	0	72	$\frac{1}{15}$th crop lodged on 1st March 1921.
12 ...			Ditto	5th March 1921.	22nd April 1921.	32	32	76	0	36	0	91	Ditto ditto.
IX (Standard) ...			Ditto	6th March 1921.	22nd April 1921.	36	0	74	16	36	0	100	Ditto ditto.
14 ...			Ditto	3rd March 1921.	22nd April 1921.	36	0	66	16	35	14	101	Ditto ditto.
15 ...			Ditto	1st March 1921.	18th April 1921.	28	16	66	0	34	28	82	
16 ...			Ditto	1st March 1921.	22nd April 1921.	26	16	56	32	33	2	80	
17 ...			Ditto	1st March 1921.	18th April 1921.	29	8	62	0	32	16	90	
IX (Standard) ...			Ditto	4th March 1921.	22nd April 1921.	32	32	77	24	32	32	100	
18 ...			Ditto	1st March 1921.	22nd April 1921.	29	32	79	0	33	8	89	
19 ...			Ditto	1st March 1921.	17th April 1921.	32	0	68	0	33	24	95	$\frac{1}{15}$th crop lodged on 1st March 1921.
20 ...			Ditto	1st March 1921.	17th April 1921.	31	24	62	32	34	0	93	Ditto ditto.
21 ...			Ditto	1st March 1921.	17th April 1921.	38	8	78	24	34	16	111	
IX (Standard) ...			Ditto	7th March 1921.	22nd April 1921.	34	32	78	32	34	32	100	
22 ...			Ditto	2nd March 1921.	17th April 1921.	30	16	69	24	34	16	88	
23 ...			Ditto	2nd March 1921.	18th April 1921.	34	32	68	16	34	0	102	
25 ...			Ditto	1st March 1921.	18th April 1921.	30	16	56	0	33	24	91	
26 ...			Ditto	3rd March 1921.	22nd April 1921.	29	8	66	32	33	16	86	
IX (Standard) ...			Ditto	6th March 1921.	22nd April 1921.	32	32	69	24	32	32	100	
27 ...			Ditto	2nd March 1921.	19th April 1921.	32	32	70	16	32	26	100	$\frac{1}{15}$th crop lodged on 1st March 1921.

Statement I—CONTINUED.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn equivalent to 100 marks. Maunds.	Seers.	Marks obtained by each type.	Remarks.
28 ...	11	1	30th October 1920.	3rd March 1921.	19th April 1921	34	16	72	30	32	20	106	1/15th crop lodged on 1st March 1921.
29 ...	28	32	Ditto	1st March 1921	Ditto	27	24	64	16	32	14	85	Ditto ditto.
30 ...			Ditto	2nd March 1921.	Ditto	32	16	70	0	32	8	101	
IX (Standard) ...			Ditto	5th March 1921.	21st April 1921	32	0	70	16	32	0	100	
31 ...			Ditto	2nd March 1921.	22nd April 1921.	31	8	64	32	31	18	100	
33 ...			Ditto	9th March 1921.	Ditto	29	24	77	24	30	36	96	
35 ...			Ditto	2nd March 1921.	19th April 1921	30	16	53	24	30	14	100	1/15th crop lodged on 1st March 1921.
36 ...			Ditto	1st March 1921	18th April 1921	25	24	76	0	29	32	86	
IX (Standard) ...			Ditto	5th March 1921.	23rd April 1921.	29	8	69	8	29	8	100	
37 ...			Ditto	2nd March 1921.	18th April 1921	30	16	75	8	29	27	102	1/15th croplodged on 1st March 1921.
38 ...			Ditto	1st March 1921	16th April 1921.	33	32	67	0	30	6	112	Ditto ditto.
39 ...			Ditto	Ditto	Ditto	26	0	73	8	30	25	85	Ditto ditto.
40 ...	11 — 28	1 — 32	Ditto	2nd March 1921.	17th April 1921.	32	32	76	0	31	4	105	Ditto ditto.
IX (Standard) ...			Ditto	6th March 1921.	27th April 1921	31	24	83	24	31	24	100	Ditto ditto.
41 ...			Ditto	28th February 1921.	18th April 1921.	30	0	74	0	31	24	95	Ditto ditto.
42 ...			Ditto	2nd March 1921.	17th April 1921.	30	24	68	24	31	24	97	Ditto ditto.
43 ...			Ditto	1st March 1921.	16th April 1921.	25	32	54	8	31	24	82	Ditto ditto.
44 ...			Ditto	Ditto	Ditto	32	0	64	0	31	24	101	Ditto ditto.
IX (Standard) ...			Ditto	6th March 1921.	21st April 1921.	24	0	73	0	31	24	100	Land being higher crop suffered for want of water.
46 ...			Ditto	26th February 1921.	16th April 1921.	32	0	66	16	30	29	104	
47 ...			Ditto	20th February 1921.	17th April 1921.	26	16	61	24	29	34	88	
48 ...			Ditto	2nd March 1921.	Ditto	32	32	63	8	28	39	113	
49 ...			Ditto	3rd March 1921.	Ditto	30	32	68	16	28	4	110	
IX (Standard) ...			Ditto	6th March 1921.	23rd April 1921.	27	8	72	0	27	8	100	
50 ...			Ditto	2nd March 1921.	18th April 1921	27	24	90	32	27	26	100	
IX (Standard) ...			31st October 1920.	6th March 1921.	28th April 1921	28	0	61	24	36	0	100	Border: 1/4th crop dried up altogether for want of water.
51 ...			Ditto	2nd March 1921.	18th April 1921	39	24	48	16	35	31	111	
52 ...			Ditto	Ditto	22nd April 1921.	42	16	73	24	35	22	112	
53 ...			Ditto	1st March 1921.	Ditto	26	32	61	8	35	13	76	
54 ...			Ditto	28th February 1921.	16th April 1921.	31	24	52	16	35	4	90	
IX (Standard) ...			Ditto	6th March 1921.	22nd April 1921.	34	32	70	32	34	32	100	
55 ...	12	1	Ditto	1st March 1921.	20th April 1921.	33	0	69	16	34	35	95	
56 ...	28	32	Ditto	Ditto	18th April 1921.	29	24	60	32	34	38	85	
57 ...			Ditto	Ditto	17th April 1921.	32	0	51	8	35	1	91	
58 ...			Ditto	Ditto	16th April 1921.	36	32	54	16	35	4	105	
IX (Standard) ...			Ditto	5th March 1921.	22nd April 1921.	35	8	70	16	35	8	100	
59 ...			Ditto	3rd March 1921.	16th April 1921.	30	0	68	16	34	19	87	
60 ...			Ditto	1st March 1921	17th April 1921.	38	32	63	24	3	30	115	
61 ...			Ditto	3rd March 1921.	Ditto	28	16	59	24	33	1	86	
62 ...			Ditto	7th March 1921.	22nd April 1921.	31	8	64	32	32	12	97	

Statement I—CONTINUED.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. *Grain.* Maunds.	*Grain.* Seers	*Bhusa.* Maunds.	*Bhusa.* Seers.	Outturn equivalent to 100 marks. Maunds.	Seers.	Marks obtained by each type.	Remarks.
IX (Standard) ..	12 / 28	1 / 32	31st October 1920.	6th March 1921.	22nd April 1921.	31	24	72	16	31	24	100	
63 ...			Ditto	4th March 1921.	18th April 1921.	30	16	64	0	31	33	96	
64 ...			Ditto	3rd March 1921.	Ditto	34	32	69	8	32	2	109	
65 ...			Ditto	1st March 1921	20th April 1921.	24	32	49	24	32	11	77	
66 ...			Ditto	2nd March 1921.	18th April 1921.	32	0	72	32	32	20	98	
IX (Standard) ...			Ditto	6th March 1921.	22nd April 1921.	32	32	76	0	32	32	100	
67 ...			Ditto	1st March 1921	17th April 1921.	30	24	58	8	32	19	94	
68 ...			Ditto	3rd March 1921.	21st April 1921.	32	0	73	24	32	6	100	
69 ...			Ditto	2nd March 1921.	Ditto	29	32	63	0	31	33	93	
70 ...			Ditto	Ditto	Ditto	34	32	58	0	31	20	110	
IX (Standard) ...			Ditto	6th March 1921.	22nd April 1921.	31	8	64	0	31	8	100	
71 ...			Ditto	1st March 1921	17th April 1921.	32	16	54	0	30	35	105	
72 ...			Ditto	Ditto	21st April 1921.	26	0	63	24	30	22	85	
74 ...			Ditto	2nd March 1921.	17th April 1921.	32	0	46	16	30	9	107	
75 ...			Ditto	Ditto	19th April 1921.	32	32	54	16	29	36	110	
IX (Standard) ...			Ditto	5th March 1921.	22nd April 1921.	29	24	64	32	29	24	100	
76 ...			Ditto	19th February 1921.	18th April 1921.	26	16	58	16	29	18	90	
77 ...			Ditto	1st March 1921	Ditto	31	8	72	0	29	12	106	
78 ...			Ditto	2nd March 1921.	17th April 1921.	28	32	70	16	29	6	99	
79 ...			Ditto	1st March 1921	19th April 1921.	26	0	72	16	29	0	90	
IX (Standard) ...	12 / 28	1 / 32	Ditto	5th March 1921.	22nd April 1921.	28	32	73	24	28	32	100	
80 ...			Ditto	3rd March 1921.	19th April 1921.	33	8	67	24	29	5	114	
81 ...			Ditto	2nd March 1921.	Ditto	29	8	67	8	29	18	99	
82 ...			Ditto	21st February 1921.	18th April 1921.	28	16	54	32	29	31	95	
83			Ditto	2nd March 1921.	19th April 1921.	32	16	72	16	30	2	108	
IX (Standard) ...			Ditto	6th March 1921.	22nd April 1921.	30	16	68	32	30	16	100	
84			Ditto	1st March 1921.	19th April 1921.	32	24	78	16	30	35	106	
85			Ditto	Ditto	Ditto	24	0	71	8	31	14	77	
86			Ditto	Ditto	Ditto	27	8	60	0	31	33	85	
87			Ditto	3rd March 1921.	17th April 1921.	34	16	71	8	32	12	107	
IX (Standard) ...			Ditto	5th March 1921.	22nd April 1921.	32	32	72	32	32	32	100	
88			Ditto	1st March 1921.	19th April 1921.	26	0	70	0	32	13	80	
89			Ditto	2nd March 1921.	Ditto.	38	16	68	32	31	34	121	
90			Ditto	1st March 1921.	17th April 1921.	33	24	68	32	31	15	107	
91			Ditto	Ditto.	20th April 1921.	26	0	70	32	30	36	84	
IX (Standard) ...			Ditto	6th March 1921.	22nd April 1921.	30	16	68	32	30	16	100	
92			Ditto	2nd March 1921.	18th April 1921.	32	32	69	24	31	33	104	
93			Ditto	1st March 1921	21st April 1921.	28	32	70	16	33	10	87	
94			Ditto	6th March 1921.	Ditto.	36	16	88	16	34	27	105	
95			Ditto	10th March 1921.	20th April 1921.	34	0	102	0	36	4	94	
IX (Standard) ...			Ditto	6th March 1921.	22nd April 1921.	37	24	95	8	37	24	100	

Statement I—CONCLUDED.

Type No. and its relative position.	Square and plot No.	Area in acres.	Date of Sowing	Date of Earing	Date of Ripening	Outturn per acre. Grain Maunds.	Grain Seers.	Bhusa Maunds.	Bhusa Seers.	Outturn equivalent to 100 marks. Maunds.	Seers.	Marks obtained by each type.	Remarks.
96			31st October 1920.	14th February 1921.	17th April 1921.	30	32	86	0	34	16	88	
97	12 / 28	1 / 32	Ditto.	2nd March 1921.	22nd April 1921.	25	8	74	0	34	16	73	Land being higher, crop suffered for want of water.
IX (Standard) ...			14th November 1920.	13th March 1921.	23rd April 1921.	22	0	46	32	29	0	100	Border: ¼th crop dried up altogether for want of water.
98			Ditto	12th March 1921.	Ditto	26	32	53	8	30	3	89	
99			Ditto	10th March 1921.	18th April 1921.	28	0	64	32	31	6	90	
100			Ditto	Ditto	23rd April 1921.	30	32	57	8	32	9	96	
101			Ditto	9th March 1921.	Ditto	29	8	60	16	33	12	88	
IX (Standard) ...			Ditto	10th March 1921.	Ditto	34	16	69	24	34	16	100	
102			Ditto	7th March 1921.	21st April 1921.	35	0	93	0	34	0	103	
103			Ditto	13th March 1921.	23rd April 1921.	34	32	72	16	33	24	104	
104			Ditto	9th March 1921.	Ditto	24	32	71	8	33	8	75	
105			Ditto	7th March 1921.	21st April 1921.	30	16	72	0	32	32	93	
IX (Standard) ...			Ditto	10th March 1921.	21st April 1921.	32	16	71	24	32	6	100	
106 ...	17 / 28	1 / 32	Ditto	8th March 1921.	Ditto	28	8	65	32	31	27	90	
107 ...			Ditto	10th March 1921.	Ditto	27	8	62	16	30	38	88	
108 ...			Ditto	9th March 1921.	23rd April 1921.	24	16	49	8	30	9	81	
109 ...			Ditto	4th March 1921.	19th April 1921.	27	24	57	8	29	20	94	
IX (Standard) ...			Ditto	9th March 1921.	23rd April 1921.	28	32	65	24	28	32	100	
110 ...			Ditto	6th March 1921.	21st April 1921.	33	24	66	16	29	24	114	
111 ...			Ditto	4th March 1921.	18th April 1921.	34	16	65	24	30	16	113	
112 ...			Ditto	9th March 1921.	Ditto	32	32	59	8	31	8	105	
113 ..			Ditto	Ditto	19th April 1921.	36	0	66	16	32	0	113	
IX (Standard) ...			Ditto	Ditto	23rd April 1921.	32	32	78	16	32	32	100	
114 ...			Ditto	Ditto	18th April 1921.	29	8	91	24	32	29	89	1/10th crop lodged on 31st March 1921.
115 ...			Ditto	2nd March 1921.	Ditto	33	16	83	16	32	26	102	
116 ...			Ditto	10th March 1921.	Ditto	32	0	78	16	32	23	98	
117 ..			Ditto	9th March 1921.	17th April 1921.	32	0	76	0	32	20	98	
IX (Standard) ...			Ditto	Ditto	23rd April 1921.	32	16	75	24	32	16	100	
118 ...			15th November 1920.	11th March 1921.	19th April 1921.	31	8	72	32	32	16	96	
119 ...			Ditto	10th March 1921.	Ditto	32	0	92	0	32	0	100	
120 ...			Ditto	9th March 1921.	22nd April 1921.	38	0	80	16	31	24	120	
121 ...			Ditto	2nd March 1921.	17th April 1921.	30	16	78	16	31	8	97	
122 ...			Ditto	3rd March 1921.	18th April 1921.	26	32	78	32	30	32	87	
IX (Standard) ..			Ditto	11th March 1921.	20th April 1921.	30	16	102	16	30	16	100	

Statement J.

Type No. and its relative position.	Plot and square No.	Area in acres.	Date of Sowing.	Date of Earing.	Date of Ripening.	Outturn per acre. *Grain.* Maunds.	*Grain.* Seers.	*Bhusa.* Maunds.	*Bhusa.* Seers.	Outturn equivalent to 100 marks. Maunds.	Outturn equivalent to 100 marks. Seers.	Marks obtained by each type.	Remarks.
Sunset I ...			30th October 1920.	16th January 1921.	15th April 1921.	12	16	30	32	28	4	44	Germination poor in $\frac{2}{3}$ area for want of moisture.
Do. II ...			Ditto	21st February 1921.	16th April 1921.	30	0	62	32	28	22	105	
Do. III ...			Ditto	22nd February 1921.	Ditto	23	8	68	0	29	0	80	
Media ...	11 / 28		Ditto	3rd March 1921.	23rd April 1921.	24	16	89	0	29	18	83	
Bancraft ...			Ditto	Ditto	Ditto	39	8	82	16	29	36	131	
Punjab IX (standard).	1 / 32		Ditto	5th March 1921.	Ditto	30	16	97	24	30	16	100	
Combuck ...			31st October 1920.	1st March 1921.	19th April 1921.	28	0	76	0	34	16	81	
Gluyas early ...			Ditto	4th March 1921.	20th April 1921.	28	32	64	0	34	16	84	
Hudson's early ...	12 / 28		Ditto	5th March 1921.	21st April 1921.	26	16	76	0	34	16	77	
John Brown ...			Ditto	8th March 1921.	22nd April 1921.	32	16	84	16	34	16	94	
Punjab IX (standard).			Ditto	5th March 1921.	Ditto	34	16	101	24	34	16	100	

Statement K.

COTTONS IN SQUARE No. 31.

Square and plot No.	Variety of cotton.	Area in acres.	Dates of Sowing.	Dates of Irrigations.	Outturns of Kapas. Actual. Maunds.	Actual. Seers.	Actual. Chataks.	Per acre. Maunds.	Per acre. Seers.	Per acre. Chataks.	Quality of soil, etc.	Length of lint in inches.	"Kan" (per cent. of fibre to unginned cotton).	Cultivation. Before sowing.	Cultivation. After sowing.	Remarks.
31/1a	G. Neglectum Var. Roseum No. 124.	½	21st April 1920	5th June 1920, 27th July 1920, 2nd September 1920, 1st October 1920, 8th October 1920, 6th November 1920 and 26th November 1920.	5	1	14	10	3	12	⅖ heavily manured, ⅗ light sandy.	·5 to ·6	36	Raja Plough=1 Desi do. =3 Harrowing =1	Hœings with horse hœ=5.	On the manured portion of the plot plants remained under sized and they shed their flowers and flower buds in very large quantity.
31/1b	285 F. ...	½	Ditto	Ditto ditto	1	28	14	3	17	12	Ditto	$1\frac{1}{8}$ to $1\frac{3}{16}$	32 to 33	Ditto ditto	Ditto ditto	Ditto ditto.
31/1c	G. Sanguineum No. 27 ...	½	Ditto	Ditto ditto	3	34	5	7	28	10	Ditto	·7 to ·8	35·8	Ditto ditto	Ditto ditto	Ditto ditto.
31/1d	285 F. ...	½	Ditto	Ditto ditto	1	24	12	3	9	8	Ditto	$1\frac{1}{8}$ to $1\frac{3}{16}$	32 to 33	Ditto ditto	Ditto ditto	Ditto ditto.
31/2a	285 F. ...	½	19th April 1920	2nd June 1920, 4th September 1920, 1st October 1920, 9th November 1920 and 26th November 1920.	2	22	2	5	4	4	Light sandy ...	$1\frac{1}{8}$ to $1\frac{3}{16}$	32 to 33	Raja Plough=1 Desi do. =6	Hœings with horse hœ=4.	Level lower than in the other plots.
31/2b	G. Neglectum Var. Roseum No. 124.	½	Ditto	Ditto ditto	3	6	5	6	12	10	Ditto ...	·5 to ·6	36	Harrowing =1	Ditto	
31/2c	285 F. ...	½	Ditto	Ditto ditto	1	16	4	2	32	8	Ditto ...	$1\frac{1}{8}$ to $1\frac{3}{16}$	32 to 33	Ditto	Ditto	Stand of crop poor.

Statement K—*concluded.*

COTTONS IN SQUARE No. 31.

Square and plot No.	Variety of cotton.	Area in acres.	Dates of Sowing.	Dates of Irrigations.	Outturns of Kapas. Actual. Maunds.	Actual. Seers.	Actual. Chataks.	Per acre. Maunds.	Per acre. Seers.	Per acre. Chataks.	Quality of soil, etc.	Length of lint in inches.	"Kan" (per cent. of fibre to unginned cotton).	Cultivation. Before sowing	Cultivation. After sowing.	Remarks.
31/2d	G. Sanguineum No. 27 ...	½	19th April 1920	2nd June 1920, 4th September 1920, 1st October 1920, 9th November 1920 and 26th November 1920.	4	16	0	8	30	0	Light sandy ...	·7 to ·8	35	Harrowing =2	Hœings with horse hoe=4.	
31/3a	168 F. ...	½	25th April 1920	10th June 1920, 1st August 1920, 14th September 1920, 3rd October 1920, 20th October 1920 and 6th November 1920.	1	34	0	3	28	0	Ditto ...	1·1	32 to 33	Raja Plough=1 Desi do. =5 Harrowing =1	Hœings with horse hœ=5.	
31/3b	G. Neglectum Var. Roseum No. 132.	½	Ditto	Ditto ditto	4	23	14	9	7	12	Ditto ...	·5 to ·6	36·8	Ditto ditto	Ditto.	
31/3c	285 F. ...	½	Ditto	Ditto ditto	1	26	15	3	13	14	Ditto ...	$1\frac{1}{8}$ to $1\frac{3}{16}$	32 to 33	Ditto ditto	Ditto.	
31/3d	G. Indicum Var. Mollisoni No. Z.	½	Ditto	Ditto ditto	3	1	14	6	3	12	Ditto ...	·6	37	Ditto ditto	Ditto.	
31/4a	G. Neglectum Var. Roseum No. 132.	½	30th April 1920	29th June 1920, 9th September 1920, 3rd October 1920, 20th October 1920 and 6th November 1920.	5	7	11	10	15	6	Fair loam ...	·5 to ·6	36·8	Raja Plough=1 Desi do. =6 Harrowing =1	Ditto.	
31/4b	168 F. ...	½	Ditto	Ditto ditto	2	9	4	4	19	12	Fair loam, partly sandy...	1·1	32 to 33	Ditto ditto	Ditto.	
31/4c	G. Indicum Var. Mollisoni No. Z.	½	Ditto	Ditto ditto	3	5	2	6	10	4	$\frac{2}{3}$ partly hard, partly sandy, rest fair loam.	·6	37	Ditto ditto	Ditto	Part of the plot very hard land. On this part majority of flowers, etc., were shed by the plants.
31/4d	285 F. ...	½	Ditto	Ditto ditto	1	39	2	3	38	4	Ditto	$1\frac{1}{8}$ to $1\frac{3}{16}$	32 to 33	Ditto ditto	Ditto	Ditto ditto. Opening was very poor.

Statement L.

COTTONS IN SQUARE No. 28.

Square and plot No.	Variety of cotton.	Area in acres.	Dates of Sowing.	Dates of Irrigations.	Outturns of kapas (cotton). Actual. Maunds.	Actual. Seers.	Actual. Chataks.	Per acre. Maunds	Per acre. Seers.	Per acre. Chataks.	Quality of soil.	Length of fibre in inches.	"Kari" (percentage of fibre to unginned cotton).	Cultivation. Before sowing.	Cultivation. After sowing.	Remarks.
28/10a	72-F.	1/30	21st April 1920	3rd May 1920, 7th May 1920, 14th June 1920, 21st June 1920, 1st August 1920, 2nd September 1920, 1st October 1920, 15th October 1920 and 19th November 1920.	0	29	9	22	6	14	Fair loam trenched ..	1·0	32	Raja Plough = 1 Desi do. = 7 Harrowing = 2	Hoeings with horse hoe = 2	
28/10a	G. Sanguineum No. 124 ...	1/60	Ditto	Ditto ditto	0	12	0	13	20	0	Fair loam	·6 to ·7	35	Ditto ditto	Ditto.	
28/10a	G. Sanguineum No. 27 ...	1/6	Ditto	Ditto ditto	3	5	14	12	35	4	Do.	·7 to ·8	35	Ditto ditto	Ditto.	
28/10a	72-F.	1/6	Ditto	Ditto ditto	1	14	14	8	9	4	Fair loam, one small portion poor.	1·0	32	Ditto ditto	Ditto.	
28/10b	280-F.	1/30	Ditto	Ditto ditto	0	28	4	21	8	8	Fair loam trenched ...	1·0	33	Ditto ditto	Ditto.	
28/10b	G. Sanguineum No. 124 ...	1/60	Ditto	Ditto ditto	0	13	2	14	10	10	Fair loam	·6 to ·7	36	Ditto ditto	Ditto.	
28/10b	276-F.	1/6	Ditto	Ditto ditto	1	24	6	9	26	4	Fair loam, part of the plot hard.	·9	34	Ditto ditto	Ditto.	
28/10b	G. Indicum No. 26 ...	1/6	Ditto	Ditto ditto	1	30	6	10	22	4	Fair loam	·8	34·0	Ditto ditto	Ditto.	
28/10c	285-F.	1/30	Ditto	Ditto ditto	0	16	10	12	10	12	Fair loam trenched, but a part of the plot hard.	1·2	33	Ditto ditto	Ditto.	
28/10c	G. Sanguineum No. 124 ...	1/60	Ditto	Ditto ditto	0	11	14	13	14	6	Ditto ditto	·6 to ·7	35	Ditto ditto	Ditto.	

Statement L—*continued.*

COTTONS IN SQUARE No. 28.

Square and plot No.	Variety of cotton.	Area in acres.	Dates of		Outturn of kapas (cotton).						Quality of soil.	Length of fibre in inches.	"Kan" (percentage of fibre to unginned cotton).	Cultivation.		Remarks.
			Sowing.	Irrigations.	*Actual.*			*Per acre.*						Before sowing.	After sowing.	
					Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.						
28/10*c*	G. Neglectum Var. Roseum No. 40.	1 6	21st April 1920	3rd May 1920, 7th May 1920, 14th June 1920, 21st June 1920, 1st August 1920, 2nd September 1920, 1st October 1920, 15th October 1920 and 19th November 1920.	1	32	0	10	32	0	Fair loam, part of plot poor.	·5 to 0·6	36·0	Raja plough = 1 Desi do. = 7 Harrowing = 2	Hoeings with horse hoe = 2	
28/10*d*	275-F. II	1 6	Ditto	Ditto ditto	0	12	8	1	35	0	Hard soil ...	0·9	33	Ditto	Ditto.	
28/10*d*	288-F.	1 30	Ditto	Ditto ditto	0	12	6	9	11	4	Fair loam trenched, part of the plot hard.	1·1	31	Ditto	Ditto.	
28/10*d*	G. Sanguineum No. 124 ...	1 60	Ditto	Ditto ditto	0	14	4	18	11	4	Fair loam	·6 to ·7	36	Ditto	Ditto.	
28/10*d*	292-F.	1 6	Ditto	Ditto ditto	0	38	14	4	35	5	Part of plot hard ...	1·1	33	Ditto	Ditto.	
28/10*d*	G. Sanguineum No. 22 ...	1 6	Ditto	Ditto ditto	1	21	4	9	7	8	Fair loam, small portion poor.	·7	32	Ditto	Ditto.	
28/10*d*	289-F.	1 30	Ditto	Ditto ditto	0	22	12	17	2	8	Fair loam trenched ...	1 3	30	Ditto	Ditto.	
28/10*e*	G. Sanguineum No. 124 ...	1 60	Ditto	Ditto ditto	0	12	0	13	20	0	Fair loam	·6 to ·7	36	Ditto	Ditto.	
28/10*e*	G. Neglectum No. 109 ...	1 6	Ditto	Ditto ditto	1	29	8	10	17	0	Do.	·7 to 8	36	Ditto	Ditto.	
28/10*e*	290-F.	1 6	Ditto	Ditto ditto	1	27	8	10	5	0	Do.	1·1	32	Ditto	Ditto.	

28/13a	G. Sanguineum No. 46 ...	1/18	26th April 1920	3rd May 1920, 14th June 1920, 29th June 1920, 18th July 1920, 2nd September 1920, 1st October 1920, 15th October 1920 and 9th November 1920.		0	16	4	7	12	8	Part of the plot hard ...	·8	33	Raja plough = 1 Desi do. = 6 Harrowing = 1	Hoeings with horse hoe = 4	
28/13a	275-F. I.	1/6	Ditto	Ditto	ditto	0	19	6	2	36	4	Hard compact soil ...	·9	33	Ditto	Ditto.	
28/13a	G. Indicum Var. Mollisoni No. 22.	1/6	Ditto	Ditto	ditto	1	13	14	8	3	4	Hard compact soil, part fair loam.	·6 to ·7	38	Ditto	Ditto.	
28/13b	American cross	1/18	Ditto	Ditto	ditto	0	19	2	8	24	4	Fair loam ...	1·0	34	Ditto	Ditto.	
28/13b	G. Indicum No. 34	1/6	Ditto	Ditto	ditto	1	39	4	11	35	8	Do.	·8	34	Ditto	Ditto.	
28/13b	161-A. F.	1/6	Ditto	Ditto	ditto	2	5	6	12	32	4	Fair loam	1·1	34	Ditto	Ditto.	
28/13c	Multani	1/18	Ditto	Ditto	ditto	0	19	8	8	31	0	Do.	·8	35	Ditto	Ditto.	
28/13c	287-F.	1/6	Ditto	Ditto	ditto	1	39	14	11	39	4	Do.	1·1	34	Ditto	Ditto.	
28/13c	G. Sanguineum No. 124 ...	1/6	Ditto	Ditto	ditto	1	29	14	10	19	4	Do	·6 to ·7	38	Ditto	Ditto.	
28/13d	199-F, ...	1/18	Ditto	Ditto	ditto	0	26	0	11	28	0	Do.	·9	33	Ditto	Ditto.	
28/13d	G. Indicum Var. Mollisoni	1/6	Ditto	Ditto	ditto	1	31	15	10	31	10	Do.	·6	38	Ditto	Ditto.	
28/13d	297-F.	1/6	Ditto	Ditto	ditto	1	29	0	10	14	0	Do.	1·1	32	Ditto	Ditto.	
28/13e	G. Indicum No. 133b ...	1/18	Ditto	Ditto	ditto	0	25	6	11	16	12	Do.	·8	29·0	Ditto	Ditto.	
28/13e	289-F.	1/6	Ditto	Ditto	ditto	1	37	2	11	22	12	Do.	1·3	31	Ditto	Ditto.	
28/13e	G. Indicum No. 38 ...	1/6	Ditto	Ditto	ditto	2	13	8	14	1	0	Do.	·8	31·5	Ditto	Ditto.	

Statement E—*concluded.*

COTTONS IN SQUARE No. 18.

Square and plot No.	Variety of cotton.	Area in acres.	Dates of Sowing.	Dates of Irrigations.	Outturns of kapas (cotton). Actual. Maunds.	Seers.	Chataks.	Per acre. Maunds.	Seers.	Chataks.	Quality of soil	Length of fibre in inches.	"Kan" (percentage of fibre to unginned cotton).	Cultivation. Before sowing.	After sowing.	Remarks.
28 / 16a	281-F.	1 / 15	3rd May 1920	7th May 1920, 21st June 1920, 27th July 1920, 5th September 1920 and 1st October 1920.	0	35	2	13	6	14	Fair loam	1	32	Raja plough = 1 Desi do. = 5 Harrowing = 2	Hoeings with horse hoe = 3	
28 / 16a	G. Sanguineum No. 46 ...	1 / 15	Ditto	Ditto ditto	0	31	14	11	38	2	Do.	·8	28	Ditto	Ditto.	
28 / 16a	American cross	1 / 15	Ditto	Ditto ditto	0	5	0	1	35	0	Sandy	1	32	Ditto	Ditto ...	Stand of crop poor.
28 / 16a	G. N. Roseum	1 / 15	Ditto	Ditto ditto	0	11	0	4	5	0	Do.	·6	37·5	Ditto	Ditto ...	Ditto.
28 / 16a	280-F.	1 / 15	Ditto	Ditto ditto	0	5	8	2	2	8	Do.	1	32	Ditto	Ditto ...	Ditto.
28 / 16a	G. Sanguineum No. 20 *a* ...	1 / 15	Ditto	Ditto ditto	0	8	4	3	3	12	Do.	·75	31	Ditto	Ditto.	
28 / 16b	G. Indicum Var. Mollisoni No. 76 *a*.	1 / 15	Ditto	Ditto ditto	0	32	0	12	0	0	Fair loam	·6 to ·7	39	Ditto	Ditto.	
28 / 16b	American Selection... ..	1 / 15	Ditto	Ditto ditto	0	37	7	12	36	9	Do.	1·1	32	Ditto	Ditto.	
28 / 16b	N. L. R. F. Sanguineum ...	1 / 15	Ditto	Ditto ditto	0	23	13	9	27	3	Fair loam, part of the plot sandy.	·75	30	Ditto	Ditto ...	Stand of the crop thin.
28 / 16b	286-F. Selection	1 / 15	Ditto	Ditto ditto	0	12	4	4	23	12	Sandy	1·1	29·3	Ditto	Ditto ...	Ditto.
28 / 16b	G. Indicum	1 / 15	Ditto	Ditto ditto	0	26	12	10	1	4	Fair land, part of it sandy	·8	34	Ditto	Ditto.	
28 / 16b	286-F.	1 / 15	Ditto	Ditto ditto	0	32	9	12	8	7	Fair loam	1·1	32	Ditto	Ditto.	

28/16c	296-F.	1/15	Ditto	Ditto	ditto	0	30	10	11	19	6	Do.	1·1	32	Ditto	Ditto.			
28/16e	G. Sanguineum No. 21 ..	1/15	Ditto	Ditto	ditto	0	31	5	11	29	11	Do.	·7 to ·8	36	Ditto	Ditto.			
28/16c	286-F.	1/15	Ditto	Ditto	ditto	0	35	10	13	14	6	Do.	1·1	31	Ditto	Ditto.			
28/16c	N. L. R. F. Sanguineum ..	1/15	Ditto	Ditto	ditto	0	21	15	8	9	0	Fair loam, partly sandy ...	·75	30	Ditto	Ditto.			
28/16c	286-F.	1/15	Ditto	Ditto	ditto	0	10	5	3	34	11	Ditto ...	1·0	34	Ditto	Ditto ...	Stand of crop poor.		
28/16c	G. Sanguineum No. 124 ...	1/15	Ditto	Ditto	ditto	0	34	6	12	35	10	Fair loam	·6 to ·7	36	Ditto	Ditto.			
28/16d	G. Indicum Var. Mollisoni ...	1/15	Ditto	Ditto	ditto	0	21	14	8	8	2	Fair loam, partly poor ...	·6	37	Ditto	Ditto.			
28/16d	American Cross	1/15	Ditto	Ditto	ditto	0	9	8	3	22	8	Ditto ..	1	33	Ditto	Ditto.			
28/16d	G. Neglectum Var. Roséum No. 22.	1/15	Ditto	Ditto	ditto	0	28	6	10	25	10	Fair loam	·6	35	Ditto	Ditto.			
28/16d	271-F.	1/15	Ditto	Ditto	ditto	0	20	2	7	21	14	Fair loam, part poor ...	1	33	Ditto	Ditto.			
28/16d	G. Indicum No. 46 ..	1/15	Ditto	Ditto	ditto	0	27	11	10	15	5	Fair loam	·8	33	Ditto	Ditto.			
28/16d	276-F.	1/15	Ditto	Ditto	ditto	0	18	8	6	37	8	Do.	·9	33	Ditto	Ditto ...	Stand of crop poor.		
28/16e	298-F.	1/15	Ditto	Ditto	ditto	0	18	0	6	30	0	Do.	1	33	Ditto	Ditto ...	Plants remained under sized.		
28/16e	G. Neglectum No. 16 ...	1/15	Ditto	Ditto	ditto	0	35	13	13	17	3	Do.	·7	33	Ditto	Ditto.			
28/16e	298-F.	1/15	Ditto	Ditto	ditto	0	15	0	5	25	0	Do.	1	33	Ditto	Ditto ...	Plants remained under sized.		
28/16e	G. Neglectum No. 128 ...	1/15	Ditto	Ditto	ditto	0	33	5	12	19	11	Do.	7	33	Ditto	Ditto.			
28/16e	286-F.	1/15	Ditto	Ditto	ditto	0	23	8	8	32	8	Do.	1·1	32	Ditto	Ditto.			
28/16e	G. Indicum Var. Mollisoni ...	1/15	Ditto	Ditto	ditto	1	6	9	17	18	7	Do.	·6	37	Ditto	Ditto.			

Statement M.

STATEMENT SHOWING THE COMPARATIVE RESULTS OF BARLEY VARIETIES GROWN IN $\frac{\text{SQUARE 46}}{\text{PLOT 24}}$ FOR THE YEAR 1920-1921.

Type No.	Area in acres.	Dates of Sowing.	Dates of Earing	Dates of Ripening	Outturn per acre Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Remarks.
I (Ly) Standard ...		18th October 1920	12th February 1921	12th April 1921	16	16	35	8	Stand of crop very poor; high lying land.
I (Hy) ...		Ditto	15th February 1921	14th April 1921	19	8	32	32	Stand of crop poor; high lying land.
I (Ho) ...		Ditto	Ditto	Ditto	25	8	44	0	
III (Gu) ...		Ditto	10th February 1921	12th April 1921	27	24	42	2	
II (Mu) ...		Ditto	17th February 1921	14th April 1921	23	8	38	0	
I (Lu) ...		Ditto	14th February 1921	Ditto	30	32	39	1	
V (Ly. E) ...		Ditto	18th February 1921	17th April 1921	21	24	34	2	Stand poor; attacked by white ants.
VI (Re) ...		Ditto	17th January 1921	24th March 1921	41	24	44	32	
Cross $\frac{N}{R}$ ..		Ditto	Ditto	Ditto	42	0	44	35	
I (Ca) ...		Ditto	15th February 1921	14th April 1921	30	0	43	8	
I (Ba) ...		Ditto	20th February 1921	15th April 1921	27	8	32	0	
I (Na) ...		Ditto	14th February 1921	14th April 1921	27	8	43	8	
I (Ly) Standard ...	$\frac{1}{32}$	Ditto	12th February 1921	12th April 1921	30	32	48	0	
VI (Gu) ...		Ditto	Ditto	Ditto	30	0	48	20	
I (Nau) ...		Ditto	Ditto	Ditto	20	32	36	32	
I (Si) ...		Ditto	27th January 1921	8th April 1921	27	28	36	32	
II (Gu. P) ...		Ditto	17th January 1921	14th April 1921	17	24	36	32	
X (Mi. P) ...		Ditto	Ditto	Ditto	23	8	48	32	
II (J. B.) ...		Ditto	15th February 1921	Ditto	20	0	40	32	
XIV (Pb) ...		Ditto	10th February 1921	Ditto	28	32	56	32	
X (Ly. p) ...		Ditto	Ditto	Ditto	22	16	48	24	
XV (B) ...		Ditto	17th February 1921	Ditto	22	0	47	8	
Carters Prolific (English)		Ditto	27th February 1921	10th April 1921	22	16	52	32	
Gold Thorp (English)		Ditto	10th February 1921	14th April 1921	15	24	39	32	
I (Ly) Standard ...		Ditto	12th February 1921	12th April 1921	34	0	48	32	
XII (Ku) ...		Ditto	14th March 1921	30th April 1921	13	24	50	16	

Note.—The above barleys were all irrigated twice, *i.e.*, on 21st November 1920 and 23th January 1921.

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PART II.

GANJI BAR EXPERIMENTAL STATION.—Chaudhri Gurdial Singh has been in charge of the station continuously for the past year as Extra Assistant Director of Agriculture. The present Assistant to the Extra Assistant Director of Agriculture is a junior man and it would conduce to the better working and management of the farm if a more experienced Assistant were posted to the Kahuta Farm (to supplement the present man, who would be capable of taking charge when the Extra Assistant Director of Agriculture is absent. Construction of the pucca buildings has already been started and their completion will remedy a long felt defect.

Kharif.—The Kharif crops mainly require a good deal of moisture for germination. The Bara soil does not hold sufficient moisture for germination, and in addition the summer heat will dry up what moisture there is before germination can take place. Irrigation water applied to facilitate germination makes the soil so hard that only some special crops will push their way through.

Thus the particular objective which has been kept in view during the past year is to experimentally determine what are the crops most suited for cultivation on bara lands on a large scale. On the experimental area the chief crops sown were rice (Oryza Sativa) and guara (Cyamopsis Psoralioides). Both the crops have a fairly reasonable germination but the plants died soon afterwards without making any appreciable growth. Guara (Cyamopsis Psoralioides) plants did not exceed the height of 3 inches, while rice (Oryza Sativa) plants with the exception of those on a few plots which had received a fairly large application of Gypsum started to wilt and die after they had attained a height of about 6". The height of rice plants even in Gypsum treated plots did not exceed $\frac{1}{1}\frac{1}{2}$ foot.

The crops treated on the non-experimental area :—Moth (phaseolus aconitifolius), Indigo (Indigoperatin etoria), Pan (Crotalaria Mucea), Mung (Phaseolus Mung), Mash (Phaseolus radiatus), Guara (Cyampasis Psoralioides), Cowpea (Vigna Catiang), Sugarcane (Saccharium Officinarum), Chari (Andropogon Sorghum), Mundal (Ebusine Coracana). With the exception of the last three all the crops were sown on land half of which was treated with 3 tons of Gypsum per acre, but there was no germination on either. Of the last three all were a failure except sugarcane.

The association of sugarcane with Bara soil may appear somewhat strange, but the experience gained during the past years would indicate that not only is sugarcane the most successful crop so far sown on Bara soil, but that it is also the most satisfactory crop for the reclamation of barasoils *per se*.

Sugarcane possesses, according to the experience gained at Kahuta certain advantages which other crops lack *viz.*—

(1) The thin variety katha appears to be able to stand heavy irrigation and is also more tolerant of lack of irrigation water than other varieties.

(2) The development of the stool will open up the soil while the decay of the roots at the end of the season will add a fairly large amount of organic matter to the soil and thereby change the texture of the soil to a great extent. Its sharp root is sure to pierce through the hard crust which is formed on the surface of the soil after irrigation.

The period during which germination may be relied on after sowing is fairly long, and hence the chances of germination are greater than with most crops. The information gained from the results of the non-experimental (Untreated) plots was very useful. As a result of this one whole rectangle (the worst of the lot) has been sown with sugarcane this year.

The germination is good and the results should be interesting, but only the chemical analysis will give us the desired information.

Rabi.—The chief crop last Rabi was wheat (Triteum-Vulgare). The experimental area was only two rectangles. Of these one was cultivated by bullock power and the other by machinery. Both were treated with Gypsum, castor cake and green manure (green manuring was only done in Rectangles 79 under bullock power). The organic manure (Castor cake) was used separately as well as in conjunction with Gypsum. The extended period just after the crops were sown, during which the canal was closed, was mainly responsible for the failure of the crop. The statements Nos. 1 and 2 give the results of wheat under these different treatments. It will be seen that wherever Gypsum is used in conjunction with castor cake as manure, the results have been good ; while some plots below the average, give decidedly hopeful results. An output of 6 maunds 25 seers per acre from one of the treated plots, is exceptionally good. It is regretted that comparative results for land cultivated by bullocks and machinery respectively are not available as the engine was not repaired in time ; it is hoped that these will be available next year.

Fodder.—The farm cannot be self supporting as regards fodder unless an exceptionally successful wheat crop is grown. The non-experimental area now yields fodder for several months, but not yet sufficient to meet requirements and bhusa has still to be purchased from outside. It is expected, however, that in the course of another year or two the farm will be quite independent of outside help in thisrespect.

Season.—The intensity of heat in the Bara was very great. The total rainfall was 1·37 inches distributed over 4 months. The heaviest shower was 0·9 inch during July and this considerably lowered the temperature for a few days. Heavy winds with dust were a general feature of the summer season.

NITROGEN FIXATION WORK.—It has been mentioned in previous reports that the fixation of nitrogen is of an extremely variable nature, with no apparent concord between the results obtained in succeeding years. The fixation of nitrogen would appear to depend upon the distribution and extent of rainfall in the first instance, and other soil conditions which it has been our aim to determine.

The particular goal to which efforts have been directed during the past year are similar to those as detailed in last year's report, *viz.*—

(1) The correlation of Nitrogen fixation with rainfall.

(2) The effects of soil sterilisation on Nitrogen fixation.

(3) The effect of cultivation.

Under 1.—The observations during the past year have been made at—

Lyallpur.
Gurdaspur.
Sargodha.
Hansi.
Okara.

The rainfall has been deficient throughout the province, more especially during the fallow period, May—October, during which we have made our analyses and specially so in the case of Okara.

The following table shows the rainfall for the past three years :—

Rainfall.

	(May—October)		
	1918.	1919.	1920.
Lyallpur	5·29	8·18	5·19
Gurdaspur	..	25·55	19·49
Sargodha	5·54	7·43	5·65
Hansi	9·42	7·14	5·65
Okara	...	8·94	0·71

During the months May—October for fallow period there was a deficient rainfall as shown by the table and last year May—October 1920, an average " loss " of nitrogen of 4·6 per cent. as compared with the 1919 results which showed a gain of 3·3 per cent. during the same period was observed. From these observations of nitrogen fixation in the field it is obviously impossible to draw any conclusions at the moment as to the connection between nitrogen fixation and rainfall.

2. *Sterilisation of soils.*—No work has been done on this subject during the last year owing to the assistant engaged on it having been on leave. Both field and laboratory experiments will be continued during the coming year, with a view of throwing further light on the problem.

3. *Effect of cultivation.*—These experiments have been continued on the lines pursued in previous years, but the results obtained would appear to contradict those of last year. For example, whereas it was found then that on cultivated land there was a loss of nitrogen to the extent of 3·3 per cent. and a gain of 3·8 per cent. on uncultivated fields ; this year there is a loss on both cultivated and uncultivated soils, the loss being greater in the latter case where it was 5·6 per cent., the loss on cultivated soil being 4·6 per cent. (see table 3rd Nitrogen fixation).

As will be seen from table 3 that there was a fixation in the Lyallpur soils where the samples were taken in the early months April and May and then again in October the results showed an average fixation of 4·6 per cent. up to the 3rd October and on the 1st October there was a loss of 3 9 per cent. The apparent loss of nitrogen in the previous year might have been due to the fact that sampling was not carried out at regular fornightly intervals and, it is proposed next year to confine attention to the Lyallpur soils and to have samples analysed fortnightly.

GREEN MANURING EXPERIMENTS.—The work of the past three years is now ready for publication as a Bulletin of the Department of Agriculture for India, and as it would be superfluous to recapitulate the whole here, I will confine myself to briefly tracing the developments succeeding last year's report.

At Lyallpur the results for the residual effect of green manuring show that the effect of green manuring in retaining moisture in the sandy plots remains at least for two years after the actual digging in of the manure. Table (No 5) gives the yield of wheat from plots under different treatment

During the year under report the work on green manuring was restricted to the Barani tracts in the Gurdaspur District.

Two factors were taken up to start with—

(1) The use of non-leguminous plants as a green manure.

(2) The efficiency of organic matter in retaining more moisture in the treated plots.

The season for wheat was rather bad for the Barani crop in the Gurdaspur District. Table 6 gives the actual output, and output per acre from the green manured plots and the controls. It will be seen from the table that the increases in the yield of the treated plots is in accordance with the amount of green manure buried, and on the whole is about 100 per cent. above the control.

SUGARCANE EXPERIMENTS.—These experiments have been carried out during the last two years at Gurdaspur. Experience has shown that most varieties of cane do not stand the low winter temperature well, a large proportion of the sucrose being inverted. The only variety indigenous to the Punjab which appears to be able to stand the winter cold without this inversion occurring to any marked degree is "Katha" This particular variety, however, has the disadvantage that it is very thin although as will appear from the table No. 7 the percentage yield of cane sugar is fairly high.

The object then, of these experiments has been to grow various varieties imported from Coimbatore and elsewhere and to determine the Sucrose content Many of these varieties have been produced by crossing experiments in order to produce a cane that will be cold-resisting, and so by growing those products in areas where such climatic conditions prevail and then analysing for sugars we have been enabled to gain information on the two important points, *viz*:—

(*a*) How the various varieties grow in these areas, and

(*b*) Their behaviour as regards sugar contents.

Under A.—I would mention that the general behaviour of the seedlings will be described in the report of the Deputy Director of Agriculture, Gurdaspur, and need not be repeated here.

Under B.—The varieties indigenous to the Punjab have so far held the first place as regards sugar content which from the table will be seen to approximate to 16·8 total sugar and gives a purity co-efficient varying from 84·5 to 89, on Barani areas, while the figures from the Chahi area are better still.

As to the Coimbatore varieties, Co. 205 has done best on both Barani and Chahi areas showing a cane sugar content of from 12·64 to 13·73 with a purity co-efficient of 79, on the Barani area On the Chahi area the Sucrose content is from 12·4 to 16 46 with a purity co-efficient of 75·52 to 77·0.

The actual figures of output per acre will be found in Deputy Director of Agriculture, Gurdaspur's report. Table 8 gives some figures of the analysis of varieties imported from other places such as United Provinces and Bihar.

A NEW METHOD FOR THE DETERMINATION OF AVERAGE DIAMETER OF A SOIL PARTICLE.—Mechanical analysis of soil gives only a rough idea about the average diameter of a soil particle. The range of variation in the sizes of different constituents of soil as determined by mechanical analysis is too great to allow any exact figure to be obtained for this. Another advantage of the new method consists in its rapidity. The time taken in mechanical analysis of soil is considerably shortened by the introduction of the centrifugal method for the separation of clay, but in spite of this it is rather a long and tedious process. By the old method one cannot analyse more than eight samples in as many days, but the method now going to be described is quick enough to give results for 4 samples a day.

Again from the mechanical analyses we can get no idea as to the permeability of a particular soil sample to air and water a knowledge which is essential to form an exact idea about its physical properties.

The formula and the abbreviated symbols used in this work are :—

A	... ...	Area of cross section of the tube.
Pa	... ...	The permeability of the soil to air.
W	... ...	Weight of soil taken for the experinment.
L	... ...	Length of soil column in the tube.
h°	... ...	Initial pressure of air as read on the manometer scale.

hf ... ... Final pressure as indicated on the manometer.

B ... ... Barometer pressure in cm.

S ... ... pore-space.

v ... ... Volume of air passed through the soil in each case.

K ... ... Constant for soil.

t ... ... time taken to pass the known volume of air through the soil.

h ... ... mean pressure.

d ... ... average diameter.

Δ ... ... Specified gravity of the soil.

R ... ... Resistance of air.

$$S = 1 - \frac{W}{l \times \Delta \times A}$$

$$Pa_{obs.} = \frac{l}{A \times 60} \cdot \frac{dv}{dt} \times \frac{i}{h}$$

$$d^2 = \frac{R\,K - P_a}{10{\cdot}2}$$

$$P_{corr.} = P_{observed}\,(1 + {\cdot}00107h)\left[1 + \frac{2ho - h}{2B + h}\right]\left\{1 + \frac{1}{v}\left(\frac{ho - hf}{2o} + \frac{ho - hf}{14}\right)\right\}$$

Description of the method and apparatus used for determining the permeability of a soil to air and the average diameter of its particle.

The work falls under the the following sub-heads :—

Preparation of the soil sample.—The soil was air dried and passed through a sieve so that almost the whole of it passed through. Different kinds of soils were taken and after passing through the sieve were stored in stoppered bottles.

Pore-space.—An iron piston just filling a copper tube was prepared in the workshops.

A weighed amount of soil was put into the thick copper tube and packed under the oil press at varying pressures.

The length of the column of soil was measured by the mirror and image arrangement The density of the soil was determined by the pyknometer method and from this data the pore-space was calculated.

Permeability to air.—The thick copper tube containing the soil was made air tight with screw tops enclosed in a glass tube jacket and put in the constant temperature bath.

A measured volume of air was pushed through the soil tube with the help of a column of mercury and the varying pressure of the air was noted on a manometer scale.

A curve showing the relation between time and pressure was plotted and from that the mean pressure was calculated with the help of a planometer.

From a mathematical curve showing the relation between pore- space and "K", the corresponding values of K for the pore-space found out were noted.

The value R was found from the Physico-chemical measurement.

Results.—The attached table No. 10 shows that variation in the pore-space do not affect the average diameter of a particle.

The diameter as calculated from the mechanical analysis agrees closely with the results obtained by this method. A slight difference up to 3 or 4 per cent. in the percentage of clay in two soils does not materially change the value for the average diameter if calculated from the mechanical analysis while it does so by the method described and the accuracy of this method lies in this very fact.

The average diameter of particles in Bara Bari, Normal and Kalrathi soils comes to about the same figure if calculated from their mechanical analysis while by this method there is striking difference in the case of kalrathi.

An accurate measurement of pore-space is a far from satisfactory problem when complicated by the ordinary field conditions and both the Permeability and Capillarity of a soil show considerable variation for a small difference in its value.

It would be more interesting and useful if permeability and pore-space were determined by taking soil sample *in situ*. A centrifugal method for confirming the results of the above method was taken in hand and its results have been sent to Mr. Wilsdon for mathematical interpretations. It is hoped that the work when more complete will be published in the Journal of Agricultural Science.

TABLE I.

Table

STATEMENT SHOWING THE RESULT OF WHEAT IN RECTANGLE

Line No. with field.	Plot No.	Treatment.	Crop and variety.	Area sown.	Date of sowing.	Date of harvesting.
Line A / 1	1	Gypsum 1 ton per acre	Wheat Type No. 11.	1,971	26th November 1920 ...	22nd April 1921 ...
	2	Gypsum 1 ton and castor cake 10 maunds per acre		1,971	Ditto ...	Ditto ...
Line A / 2	1	No gypsum		1,971	Ditto ...	Ditto ...
	2	Castor cake 10 maunds per acre		1,971	Ditto ...	Ditto ...
Line A / 3	1	Gypsum 2 tons per acre...		1,971	Ditto ...	Ditto ...
	2	Gypsum 2 tons and castor cake 10 maunds per acre		1,971	Ditto ...	Ditto ...
Line A / 4	1	No gypsum		1,971	Ditto ...	Ditto ...
	2	Castor cake 10 maunds per acre		1,971	Ditto ...	Ditto ...
Line B / 1	1	Gypsum 3 tons per acre		2,330	Ditto ...	Ditto ..
	2	Gypsum 3 tons and castor cake 20 maunds per acre		2,330	Ditto ..	Ditto ...
Line B / 2	1	No gypsum		2,330	Ditto ...	Ditto ...
	2	Castor cake 20 maunds per acre		2,330	Ditto ...	Ditto ...
Line B / 3	1	Gypsum 5 tons per acre		2,330	Ditto ...	Ditto ...
	2	Gypsum 5 tons and castor cake 20 maunds per acre		2,330	Ditto ...	Ditto ...
Line B / 4	1	No gypsum		2,330	Ditto ...	Ditto ...
	2	Castor cake 20 maunds per acre		2,330	Ditto ...	Ditto ...
Line C / 1	...	Gypsum 1 ton per acre		4,460	25th November 1920 ...	23rd April 1921 ...
Line C / 2	...	No gypsum		4,460	Ditto ...	Ditto ...
Line C / 3	...	Gypsum 2 tons per acre...		4,460	Ditto ...	Ditto ...
Line C / 4	...	No gypsum		4,460	Ditto ...	Ditto ...
Line D / 1	1	Gypsum 1 ton per acre		2,264	Ditto ...	Ditto ...
	2	Gypsum 1 ton and castor cake 10 maunds per acre		2,264	Ditto ...	Ditto ...
Line D / 2	1	No gypsum		2,264	Ditto ...	Ditto ...
	2	Castor cake 10 maunds per acre		2,264	Ditto ...	Ditto ...
Line D / 3	1	Gypsum 4 tons per acre		2,264	Ditto ...	Ditto ...
	2	Gypsum 4 tons and castor cake 10 maunds per acre		2,264	Ditto ...	Ditto ...
Line D / 4	1	No gypsum		2,264	Ditto ...	Ditto ...
	2	Castor cake 10 maunds per acre		2,264	Ditto ...	Ditto ...
Line E / 1	1	Untreated (no gypsum)		2,264	20th November 1920 ...	Ditto ...
	2	Castor cake 20 maunds per acre		2,264	Ditto ...	Ditto ...
Line E / 2	1	Untreated (no gypsum)		2,264	Ditto ...	Ditto ...
	2	Castor cake 20 maunds per acre		2,264	Ditto ...	Ditto ...
Line E / 3	1	Gypsum 2 tons per acre		2,264	Ditto ...	Ditto ...
	2	Gypsum 2 tons and castor cake 20 maunds per acre		2,264	Ditto ...	Ditto ...
Line E / 4	1	Untreated (no gypsum)...		2,264	Ditto ...	Ditto ...
	2	Castor cake 20 maunds per acre		2,264	Ditto ...	Ditto ...

I.

88 UNDER STEAM CULTIVATION DURING RABI 1920-21.

Actual outturn.						Outturn per acre.						Remarks.
Grain.			*Straw.*			*Grain.*			*Straw.*			
Maunds.	Seers.	Chhataks.	Maunds.	Seers.	Chhataks.	Maunds.	Seers.	Chhataks.	Maunds.	Seers.	Chhataks.	
0	2	12	0	6	4	0	6	4	0	15	5	Cultivator ... = 3
0	1	12	0	3	4	0	4	4	0	7	15	Dist harrow = 1
0	1	0	0	3	0	0	2	7	0	7	5	Watering ... = 6
0	5	4	0	9	12	0	13	0	0	23	15	
0	3	8	0	11	0	0	8	10	0	27	0	
0	6	0	0	18	0	0	14	12	1	4	2	
0	0	6	0	1	10	0	0	15	0	4	0	
0	0	12	0	4	4	0	1	14	0	10	6	
0	8	0	0	15	0	0	16	9	0	31	2	
0	39	0	2	3	0	2	1	0	4	12	6	
...	...	...	...	...	...	...	...	...	...	...	...	
0	10	8	0	23	0	0	21	10	1	7	12	
0	6	6	0	25	10	0	13	3	1	13	3	
0	38	8	2	4	8	1	39	8	4	15	4	
0	0	2	0	0	14	0	0	3½	0	1	13	
0	3	8	0	13	8	0	7	5	0	28	0	
0	10	8	0	24	8	0	11	6	0	26	9	
0	8	4	0	22	12	0	8	14	0	24	11	
0	5	10	0	17	3	0	6	2	0	18	10	
0	2	2	0	5	4	0	2	5	0	5	11	
0	3	0	0	6	8	0	6	7	0	13	9	
0	5	8	0	19	8	0	11	12	1	1	8	
0	1	8	0	4	8	0	3	3	0	9	9	
0	3	0	0	7	0	0	6	6	0	14	5	
0	12	8	0	25	8	0	26	14	1	22	8	
0	3	12	0	29	4	0	29	7	0	10	2	
0	1	12	0	4	12	0	3	11	0	10	2	
0	9	12	0	22	12	0	26	13	1	8	10	
...	...	...	...	...	...	...	...	...	...	...	...	
0	25	0	1	32	0	1	13	7	3	13	15	
0	1	12	0	3	12	0	3	11	0	8	0	
0	5	6	0	19	12	0	11	8	1	2	3	
0	2	4	0	7	12	0	4	12	0	16	9	
0	18	0	1	1	0	0	38	9	2	7	19	
0	0	2	0	0	6	0	0	4	0	0	13	
0	9	0	0	21	0	0	19	4	1	4	14	

Table

STATEMENT SHOWING THE RESULTS OF WHEAT IN RECTANGLE 79

Line No. with field.	Plot No.	Treatment.	Crop and variety.	Area sown.	Date of sowing.	Date of harvesting.
Line A / 1	1	Gypsum 2 tons per acre	Wheat Type No. 11.	2,755	15th October 1920 ...	19th April 1921 ...
	2	Gypsum 2 tons and castor oil cake 10 maunds per acre.		1,149	Ditto ...	Ditto ...
Line A / 2	1	Untreated		2,755	17th October 1920 ...	Ditto ...
	2	Castor cakes 10 maunds per acre		1,148	Ditto ...	Ditto ...
Line A / 3	1	Gypsum 1 ton per acre		2,755	15th October 1920 ...	Ditto ...
	2	Gypsum 1 ton and castor cake 10 maunds per acre		1,148	Ditto ...	Ditto ...
Line A / 4	1	Untreated		2,755	16th October 1920. ...	Ditto ...
	2	Castor cake 10 maunds per acre		1,148	Ditto ...	Ditto ...
Line B / 1	1	Gypsum 5 tons per acre...		3,448	15th October 1920 ...	Ditto ...
	2	Gypsum 5 tons and castor cake 20 maunds per acre		1,148	Ditto ...	Ditto ...
Line B / 2	1	Untreated		3,443	19th October 1920 ...	Ditto ...
	2	Castor cake 20 maunds per acre		1,148	23rd October 1920 ...	Ditto ...
Line B / 3	1	Gypsum 3 tons per acre		3,443	19th October 1920 ...	Ditto ...
	2	Gypsum 3 tons and castor cake 20 maunds per acre		1,148	18th October 1920 ...	Ditto ...
Line B / 4	1	Untreated		3,443	19th October 1920 ...	Ditto ...
	2	Castor cake 20 maunds per acre		1,148	Ditto ...	Ditto ...
Line C / 1	1	Gypsum 2 tons per acre		3,443	15th October 1920 ...	20th April 1921 ...
	2	Gypsum 2 tons and green manuring with Guara		1,148	29th October 1920 ...	Ditto ...
Line C / 2	1	Untreated		3,443	19th October 1920 ...	Ditto ...
	2	Guara green manuring		1,148	1st November 1920 ...	Ditto ...
Line C / 3	1	Gypsum 1 ton per acre		3,443	19th October 1920 ...	Ditto ...
	2	Gypsum 1 ton and guara green manuring ...		1,148	1st November 1920 ...	Ditto ...
Line C / 4	1	Untreated		3,443	21st October 1920 ...	Ditto ...
	2	Guara (green manuring)		1,148	23rd October 1920 ...	Ditto ...
Line D / 1	1	Gypsum 4 tons per acre		3,443	25th October 1920 ...	Ditto ...
	2	Gypsum 4 tons and castor cake 10 maunds per acre		1,148	Ditto ...	Ditto ...
Line D / 2	1	Untreated		3,443	29th October 1920 ...	Ditto ...
	2	Castor cake 10 maunds per acre		1,148	25th October 1920 ...	Ditto ...
Line D / 3	1	Gypsum 1 ton per acre		3,443	1st November 1920 ...	Ditto ...
	2	Gypsum 1 ton and castor cake 10 maunds per acre		1,148	Ditto ...	Ditto ...
Line D / 4	1	Untreated.		3,443	Ditto ...	Ditto ...
	2	Castor cake 10 maunds per acre		1,148	Ditto ...	Ditto ...
Line E / 1	1	Gypsum 2 tons per acre...		3,443	25th October 1920 ...	Ditto ...
	2	Gypsum 2 tons and castor cake 20 maunds per acre		1,148	Ditto ...	Ditto ...
Line E / 2	1	Untreated		3,443	27th October 1920 ...	Ditto ...
	2	Castor cake 20 maunds per acre		1,148	Ditto ...	Ditto ...
Line E / 3	1	Untreated		3,443	Ditto ...	Ditto ...
	2	Castor cake 20 maunds per acre		1,148	Ditto ...	Ditto ...
Line E / 4	1	Untreated		3,443	Ditto ...	Ditto ...
	2	Castor cake 20 maunds per acre		1,148	Ditto ...	Ditto ...

II.

UNDER BULLOCK POWER DURING RABI 1920-21.

Actual outturn.						Outturn per acre.						Remarks.
Grain.			*Straw.*			*Grain.*			*Straw.*			
Maunds.	Seers.	Chhataks.	Maunds.	Seers.	Chhataks.	Maunds.	Seers.	Chhataks.	Maunds.	Seers.	Chhataks.	
0	19	12	1	3	0	0	34	11	1	35	9	Raja plough ... 2
1	6	8	2	1	8	4	36	0	8	23	9	Country plough 4
0	1	10	0	4	6	0	2	14	0	7	11	Sohaga ... 3
0	16	10	0	29	6	1	30	1	3	13	3	Watering ... 8
0	8	4	0	28	12	0	14	8	1	10	8	
0	24	0	1	7	0	2	21	3	4	38	3	
0	35	0	1	28	0	1	21	8	2	38	7	
0	11	8	0	20	8	1	8	8	2	6	7	
0	14	8	1	1	8	0	20	6	1	18	5	
0	39	8	1	34	8	4	6	8	7	34	0	
0	0	8	0	4	8	0	0	11	0	6	5	
0	12	0	0	28	0	1	10	9	2	38	0	
1	23	0	2	39	0	2	8	9	4	7	4	
1	23	0	2	29	0	6	25	9	11	19	8	
0	18	8	0	33	8	0	26	0	1	7	1	
0	9	12	0	21	4	1	1	0	2	9	4	
0	31	0	2	0	0	1	4	9	2	32	7	
1	10	0	2	12	0	5	10	12	9	27	14	
0	9	6	0	23	10	0	13	15½	0	33	3	
0	17	10	0	31	6	1	34	6	3	12	4	
0	1	6	0	3	10	0	1	15	0	5	1	
0	34	8	1	16	8	3	25	6	5	38	2	
0	0	12	0	1	12	0	1	0	0	2	7	
0	30	0	1	10	0	3	6	7	5	10	12	
0	9	8	1	1	8	0	13	5	1	18	6	
0	30	8	1	24	8	3	8	9	6	32	0	
0	1	12	0	6	4	0	2	7	0	8	12	
0	0	6	0	1	10	0	1	9	0	6	13	
4	9	12	0	26	4	0	13	11	0	36	14	
0	18	0	0	35	0	1	35	14	3	27	9	
0	6	8	0	13	8	0	9	2	0	18	15	
0	6	8	0	14	8	0	27	13	1	8	7	
0	14	8	0	30	8	0	20	6	1	2	14	
0	11	8	0	26	8	1	8	7	2	31	11	
0	0	12	0	1	12	0	1	½	0	2	7	
0	1	4	0	3	12	0	5	4	0	15	14	
0	4	8	0	10	8	0	6	5	0	14	12	
0	1	12	0	4	4	0	7	6	0	17	14	
0	1	12	0	5	12	0	2	7	0	8	0	
0	6	0	0	24	0	0	25	5	2	21	3	

Table III.

NITROGEN FIXATION IN PUNJAB SERIES FOR 1920-21.

Locality.	23rd June 1920.	3rd October 1920.			18th October 1920.			3rd November 1920.			Detail of Operations.	Rainfall.	
	Miligrams of Nitrogen per 100 grams of dry soil (Original),	Miligrams of Nitrogen per 100 grams of dry soil.	Nitrogen fixed or lost in 100 grams of dry soil.	Loss or gain of Nitrogen per cent.	Miligrams of nitrogen per 100 grams dry soil.	Nitrogen fixed or lost in 100 grams of dry soil.	Loss or gain of Nitrogen per cent.	Miligrams of Nitrogen per 100 grams of dry soil.	Nitrogen fixed or lost in 100 grams of dry soil.	Loss or gain of Nitrogen per cent.			
Lyallpur square 3-F. 2 Light oil normal	37·2	37·2	0	0	39·6	—2·4	—6·45	36·3	—0·9	—2·4	Ploughed on 4th August 1920, 12th September 1920 and 3rd October 1920, Sohaga 20th September 1920.	July 15th ... 0·03 „ 26th ... 0·12 „ 28th ... 0·34	
Ditto ditto Blank ...	39·0	42·4	—3·4	—8·7	41·75	2·75	—7·5	39·8	—0·8	—2·0	No operations ...	August 3rd ... 0·9 „ 4th ... 0·26 „ 14th ... 0·58 „ 15th ... 0·1 „ 17th ... 1·33 September 8th 1·53	
Lyallpur square normal. 16-F. 16 Heavy soil	63·4	63·6	—0·2	—0·3	60·2	—3·2	—5·05	57·5	—5·9	—9·3	Ploughed on 7th August 1920, 22nd August 1920, 28th September 1920 and 9th October 1920.		
Ditto ditto Blank ...	53·5	58·6	—5·1	—9·5	56·7	—3·2	—5·9	50·3	—3·2	—5·9	No operations.		
												Total ... 5·19	

NORMAL :—Receiving ordinary cultivation as practised by Zamindars.

BLANK :—No operations except the removal of wheats.

Table IV.

Locality.	Miligrams of Nitrogen per 100 Grams of dry soil		Nitrogen fixed or lost per 100 grams of dry soil.	Loss or gain of nitrogen per cent.	Operations.	Rainfall.		
	May 1920.	October 1920.						Inches.
Gurdaspur Normal ...	58·3	57·3	—1·0	—1·7	Harrowings 25th May 1920, 28th May 1920, 25th June 1920, 25th July 1920, 11th August 1920, 6th September 1920, 9th September 1920, 16th September 1920, 21st September 1920, and 16th October 1920. Ploughings 23rd June 1920, 24th July 1920, 15th September 1920, 2nd October 1920, 9th Octber 1920 and 16th October 1920; hoeings 10th August 1920 and 28th August 1920; sohaga 6th September 1920, 15th September 1920, 16th September 1920, 21st September 1920, 2nd October 1920, 9th October 1920 and 16th October 1920.	June 1920		1·16
						July 1920		8·42
						August 1920		6·5
						September 1920		3·41
						Total ...		19·49
Sargodha Normal ...	38·22	40·33	—2·11	—5·5	Harrow and plough 6th August 1920, horse hoe 11th September 1920, irrigated on 13th October 1920, harrow and Sohaga 7th October 1920; Desi plough and sohaga 9th October 1920 and 10th October 1920; sowings on 10th October 1920; Bar harrow 8th October 1920.	May 10th		·10
						„ 23rd		·11
						„ 27th		·100
						July 8th		·12
						„ 25th		·10
						„ 27th		1·47
						August 2nd		2·6
						„ 16th		·1
						September 18th		·88
Blank ...	47·32	42·63	—4·69	—9·9	No operation from May to 3rd October, irrigated on 7th October 1920, ploughed on 9th and 10th October, Sohaga 9th and 10th October, Bar arrow 8th November 1920.	June 12th		·52
						„ 20th		·08
						„ 28th		·05
						Total ...		5·65
Hansi Normal ...	47·95	45·15	—2·8	—5·8	Harrow 22nd May 1920, Raja plough 7th August 1920, harrow 10th August 1920, desi plough 21st August 1920.	July 12th		1·1
						„ 13th		·06
						„ 14th		·03
						„ 16th		·16
						„ 27th		2·08
						„ 28th		·46
						„ 29th		·16
						„ 30th		·21
Blank ...	48·3	42·7	—5·6	—11·6	No operations ...	June 25th		·1
						May 9th		·01
						„ 21st		·3
						„ 25th		·25
						„ 26th		·29
						Total ...		5·65
Okara Normal ...	53·06	45·5	—7·6	—14·2	One deep cultivation with plough.	August		0·46
						September		0·25
Blank ...	46·97	45·92	—1·05	—2·3	No operations ...	Total ...		0·71

NORMAL:—Receiving ordinary cultivation as is done by Zamindars during the fallow period.

BLANK.—No operations except the remeval of wheats.

Average loss of nitrogen for the whole province—5·06

Table V.

YIELDS.

Big plots. G. M. Experiments. 1920-21. Students' Farm.

No.	Plot.	Yield.				Yield per acre.				Remarks.
		Grain.		*Straw.*		*Grain*		*Straw.*		
		Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	
	Sandy 1/10th acre.									
1	Guara 1 crop	1	10	2	38	12	20	29	20	
2	„ 2 „	1	32	3	31	18	0	37	30	
3	„ 3 „	2	17	4	26	24	10	46	20	
4	Control average of 3 plots	0	39	1	37	9	30	19	10	
	Stiff 1/20th acre.									
1	Guara 1 crop	1	4	2	5	22	0	42	20	
2	„ 2 „	1	6	2	15	23	0	47	20	
3	„ 3 „	1	21½	2	34	30	30	57	0	
4	Control avezage of 3 plots	0	37	1	22	18	20	31	0	

Table VI.

RESULTS OF GREEN MANURING EXPERIMENTS WITH BHANG CARRIED OUT IN FIELD No. C-1 DURING RABI 1920-21.

Plot.	Treatment.	Actual Outturn.				Outturn per acre.				% Increase on control.		Remarks.
		Grain.		*Straw.*		*Grain.*		*Straw.*				
		Maunds.	Seers.	Maunds.	Seers.	Maunds.	SSeers.	Maunds.	Seers.	Grain.	Straw	
1	Bhang 24 maunds	0	21½	1	7	5	17	11	34	87	124	
2	Control	0	11½	0	21	2	36	5	12	...	...	
3	Bhang 48 maunds	0	23½	1	10	5	37	12	24	96	85	
4	Control	0	12	0	27	3	1	6	32	...	...	
5	Bhang 72 maunds	0	25	1	23	6	12	15	35	93	132	
6	Control	0	13	0	27	3	11	6	32	...	...	
7	Bhang 24 maunds	0	21	1	13	5	12	13	14	75	89	
8	Control	0	12	0	28	3	1	7	3	...	...	
9	Bhang 8 maunds	0	26	1	31	6	22	17	36	108	122	
10	Control	0	12½	0	33	3	6	8	2	...	...	
11	Bhang 72 maunds	0	30	2	7	7	22½	21	30	130	63	
12	Control	0	13	1	12	3	11	13	14	...	...	

Table VII.

I.—BARANI CANE.

Local and Coimbatore variety at Gurdaspur Farm.

Name of cane.	Date of analysis.	% Juice.	% Glucose.	% Sucrose.	Total sugars.	Total solids (Brix).	Glucose Ratio.	Purity co-efficient.	Remarks.
Katha ...	26th November 1920 ...	50·38	0·49	17·40	17·90	19·93	1·79	87·28	I (Plot).
Do. ...	Ditto	53·74	0·62	17·38	18·00	20·16	3·57	86·21	II „ / I „
Do. ...	14th December 1920 ...	52·32	0·70	15·92	16·62	18·85	4·4	84·46	
Dhaula ...	26th November 1920 ...	51·11	0·59	15·47	16·06	17·43	3·88	88·82	
Do. ...	16th December 1920 ...	55·80	0·74	17·37	18·11	19·93	4·26	87·16	
C0 205 ...	27th November 1920 ...	57·10	1·52	12·64	14·16	16·01	12·02	78·96	
Do. ...	14th December 1920 ...	53·91	2·33	13·61	15·94	17·0	17·12	80 06	
C0 202 ...	26th November 1920 ...	56·43	1·28	13·07	14·35	16·22	9·79	80·58	
Do. ...	16th December 1920 ...	Spoiled	1·34	13·73	15·07	17·26	9·80	79·55	

Table VIII.

II.—CHAHI CANES (FARM).

Name of cane.	Date of analysis	% Juice.	% Glucose.	% Sucrose.	Total sugars.	Total solids (Brix).	Glucose Ratio.	Purity co-efficient.	Remarks.
Katha ...	14th December 1920 ...	54·11	0·89	17·12	18·01	20·56	5·20	83·75	
Do. ...	27th January 1921 ...	62·22	1·15	16·92	18·07	20·78	7·0	81·33	
Do. ...	28th February 1921 ...	63·11	0·28	18·71	18·99	22·3	1·5	83·90	
Yuba ...	15th December 1920 ...	67·75	2·02	15·16	17·18	18·83	13·3	80·51	
Do. ...	27th January 1921 ...	72·19	0·92	17·07	17·99	19·88	5·4	80·83	
Suretha ...	15th December 1920 ...	63·59	1·19	15·76	16·95	19·93	7·64	79·08	
Do. ...	28th January 1921 ...	63·57	0·45	16·17	16·62	20·15	2·8	80·25	
Do. ...	27th February 1921 ...	56·10	1·07	17·37	18·44	21·75	6·16	79·90	
J. 36 ...	15th December 1920 ...	69·66	1·06	16·34	17·40	19·03	6·51	85·86	
Do. ...	28th January 1921 ...	72·97	0·36	17·92	18·28	20·25	2·02	87·41	
Do. ...	27th February 1921 ...	66·71	0·42	17·55	17·97	20·06	2·4	87·48	
Dhaula ...	15th December 1920 ...	58·34	0·41	17·44	17·85	20·74	2·34	84·9	
Do. ...	27th January 1921 ...	59·51	0·41	18·16	18·57	20·88	2·26	87·0	
Do. ...	28th February 1921 ...	56·26	0·70	17·95	18·65	21·50	4·0	83·48	
Behar ...	18th December 1920 ...	70·69	2·39	13·06	15·48	18·88	18·13	77·70	
Do. ...	27th January 1921 ...	71·99	1·40	16·11	17·51	19·08	8·70	84·44	
J. 105 ...	18th December 1920 ...	70·00	1·32	15·35	16·67	18·52	8·6	82·89	
U. P. 11 ...	Ditto ...	72·26	1·32	15·01	16·33	17·40	8·81	86·36	
Do. ...	28th February 1921 ...	69·74	0·65	16·91	17·55	19 0	3 80	89·00	
Khadya ...	18th December 1920 ...	69·08	1·32	12·65	13·97	16·08	10·5	78·73	
Red Mauritius ...	19th December 1920 ...	71·83	2·11	11·65	13·76	15·39	13·14	75·7	
Green Sports ...	Ditto ...	71·99	1·58	16·62	18·19	19·23	9·50	86·3	
Stripped Mauritius ...	Ditto ...	71·94	1·53	15·91	17·44	17·9	9·64	88·37	

Table IX.

III.—COIMBATORE CANES—GROWN AT GURDASPUR FARM (CHAHI).

Name of cane.	Date of analysis.	% Juice.	% Glucose.	% Sucrose.	Total sugars.	Total solids (Brix).	Glucose Ratio.	Purity Co-efficient.	Remarks.
CO. 205 ...	14th December 1920 ...	61·38	2·50	13·75	16·25	18·04	18·18	76·22	
Do. ...	25th January 1921 ...	65·91	1·17	12·40	13·57	16·42	9·5	75·52	
Do. ...	26th February 1921 ...	57·71	1·59	13·25	14·85	16·76	12·0	77·76	
CO. 204 ...	16th December 1920 ...	66·13	2·85	11·38	14·23	16·72	25·07	68·07	
Do. ...	25th January 1921 ...	66·99	0·81	12·23	13·03	15·75	6·6	77·70	
Do. ...	27th February 1921 ...	60·74	1·28	11·88	13·16	15·7	10·8	75·67	
CO. 202 ...	16th December 1920 ...	55·12	1·38	14·42	15·80	17·82	9·6	80·92	
Do. ...	25th January 1921 ...	59·10	0·45	16·46	16 92	17·98	2·78	91·55	
Do. ...	27th February 1921 ...	56·40	0·37	16·24	16·61	18·6	2·27	87·31	
CO. 206 ...	17th December 1921 ...	66·13	2·73	12·25	14·98	17·00	22·35	71·90	
Do. ...	26th January 1921 ...	64·45	1·16	13·22	14·32	17·00	8·77	77·76	
Do. ...	27th February 1921 ...	61·94	1·09	14·80	15·89	18·06	7·40	82·00	
CO. 216 ...	17th December 1920 ...	63·43	2·22	13·48	15·70	17·00	16·46	89·39	
Do. ...	25th January 1921 ...	64·45	1·37	11·45	12·82	15·92	12·0	71·99	
Do. ...	26th December 1920 ...	61·13	0·87	14·21	15·08	17·8	6·12	80·00	
CO. 221 ...	19th December 1920 ...	70·68	1·35	16·49	17·84	18·76	8·18	87·37	
Do. ...	26th January 1921 ...	69·11	0·55	17·25	19·80	19·50	3·18	88·5	
Do. ...	26th February 1921 ...	65·99	0·43	18·32	18·75	20·82	2·35	88·0	
CO. 222 ...	17th December 1921 ...	63·22	2·30	11·98	14·28	17·25	19·18	69·47	
Do. ...	26th January 1921 ...	58·87	0·98	13·69	14·67	17·2	7·20	79·60	
Do. ...	26th February 1921 ...	56·50	1·16	13·79	14·85	18·0	8·41	76·61	
CO. 223 ...	17th December 1920 ...	63·71	1·32	15·09	16·41	18·52	8·73	82·31	
Do. ...	26th January 1921 ...	64·79	0·78	16·73	17·51	19·51	4·70	85·75	
Do. ...	26th February 1921 ...	65·45	0·63	17·78	18·41	20·6	3·54	86·31	

Table X.

DETERMINATION OF PERMEABILITY AND AVERAGE DIAMETER OF PARTICLES OF DIFFERENT SOILS PACKED AT DIFFERENT PRESSURES.

VOLUME OF AIR PASSED THROUGH = 110·1.
AREA OF THE CROSS-SECTION OF SOIL TUBE = Π × (1·76)².
R AT 25° C = ·000189.

Kind of soil.	Weight of soil. W	Length of soil column l.	h_o	h_f	B	Pore-Space.	K.	time t	mean pressure h	P a observed.	P a corrected.	Average diameter d	Pressure applied for compressing to soil.
Air-dried	32·7211	1·718	9·6	5	74·57	·2053	170	8′ 32″	6·91	·005483	·005985	·004342	2 tons
Oven-dried	33·0199	1·841	7·95	4·45	75·185	·2515	92	4′ 36″	6·066	·01244	·01334	·004768	Pressed at 2 tons
Ditto	33·0199	1·757	9	4·75	75·185	·2157	147	6′ 29″	6·83	·007423	·008035	·004678	4 tons
Ditto	33·0199	1·690	10	5·2	75·185	·1847	215	9′ 53″	7·3	·004416	·004848	·004394	6 tons
Air-dried	32·3661	1·836	7·5	4·2	75·21	·2856	61	4′ 5″	6·14	·01402	·01497	004021	tons
Ditto	32·3661	1·802	8·55	...	75·21	·2506	94	5′ 53″	6·631	·009315	·01002	·004178	2 tons
Sandy soil	34·0787	1·854	1·1	·7	74·6	·2330	118	2′ 0″	·82	·2131	·2151	·02434	Do.
Ditto	34·0787	1·735	2	1·18	74·6	·1802	225	2′ 5″	1·475	·1084	·1085	·02127	Do.
Sandy air-dried	33·4896	1 760	1·2	·7	74·975	·2034	165	2′ 0″	·9761	·1700	·1717	·02292	Do.
Sandy oven-dried	33·4111	1·782	1·1	·55	74·3	·2179	144	2′ 0″	·8571	·1930	·1930	·02299	Do.
Loamy air-dried	31·7576	1·804	9·3	4·9	74·975	·2211	139	6′ 47″	7·044	·007119	·007743	·004466	Do.
Kalrathi	33·1436	1·731	10·3	5·1	74·65	·2002	179	10′ 35″	7·387	·004175	·004586	·003900	Do.
Normal	32·9091	1·764	8·55	4·6	74·835	·2207	139	5′ 11″	6·488	·009891	·01068	005216	Do.
Bari	33·0331	1·764	8·9	4·7	74·73	·2177	144	5′ 45″	6·842	·008453	·009152	·004942	Do.
Maira	32·4746	1·807	3·7	2·1	74·78	·2492	95	2′ 25″	2·769	·05089	·05236	·009601	Do.
Bara	32·7948	1·779	7·75	4·75	74·78	·2298	123	5′ 53″	6·646	·005578	·009177	·004574	Do.

Annual Report of the Entomologist to the Government, Punjab, Lyallpur.

Part II.

I.—General.

Staff.—I remained in charge of the Section throughout the year. During the year under review there have been many changes in the Entomological Section. Lala Madan Mohan Lal, the Assistant Professor of Entomology, went on a combined leave for 1½ years on 14th August 1920. He went to Europe for higher study in Entomology and Sericulture.

Sardar Hem Singh Pruthi, M. Sc. (Zoology), was appointed to the newly sanctioned post of Demonstrator in Zoology, on 25th August 1920, and from 4th October 1920 he has been officiating for the Assistant Professor of Entomology. Lala Harnam Dass, M. Sc. (Zoology), was appointed officiating Demonstrator in Zoology on 4th October 1920.

Lala Tehl Ram was transferred to the Agricultural Section on 27th October 1920 and his post remained vacant till 28th February 1921 as no suitable man was available, and the pay was not attractive enough for those who were available. Sayed Abdullah Shah, an old student of this College, was appointed to this post on 28th February 1921.

Lala Kesho Dass, M. Sc. (Zoology), joined on 7th June 1921 as Agricultural Assistant. This post was sanctioned last year, but could not be filled as no suitable man was available.

Thus for the greater part of the year the originally small section remained understaffed, consequently many important problems remained untouched.

Increase in the staff is badly needed. It will not be out of place to mention that we have experienced very great difficulty in recruiting men for the post of Agricultural Assistant in the Entomological Section.

Applied Zoology (including Entomology) is not taught in the higher classes with the result that students of this college are not competent to take up research in this science, and graduates in Zoology do not accept the low pay offered by the Department. Reform in both directions is urgently needed.

Teaching.—Further changes have been made both in teaching of Zoology and Entomology. Animal Physiology, which is more important from the point of view of the Agricultural Student than Morphology, has been included in the courses and now forms an important part of the syllabus Anatomy of farm animals has been added to the course. The standard of teaching has been raised. It is however impossible to do very much in the short time devoted to these subjects in the college time-table. It is highly essential that changes should be made in the present system. A circular letter, issued to the Deputy Directors of Agriculture, has elicited the following facts :—

1. The present Agricultural Assistants on district work are not capable of recording entomological data and carrying out measures suggested against insect pests.

2. The teaching of entomology has been such that those who pass out of this college do not know enough to be of any use in entomological work.

The Deputy Directors of Hansi and Gurdaspur agree that higher training in entomology is essential for the Agricultural Assistants on district work. It is highly desirable that higher teaching in Applied Zoology should form an essential part of the training of some of our youths who go up for the degree of B. Sc. in Agriculture.

I do not know of any place in the whole of India where a student can receive education in Applied Zoology, and it will be for the good of this province if we have men trained in entomology to take up work in the proposed extension of the entomological Services. I want to draw the attention of the authorities concerned towards the state of entomological training in this country. When staff capable of giving higher training in Applied Zoology is available, there is no reason why those of the agricultural students, who are interested in these subjects, should not be given a choice of specialising in this branch of the science of Agriculture. It is unfortunate that mainly on account of ignorance and partially through prejudice, the true value of Applied Zoology to the agriculture of this country has not been fully recognised. The following lines from a letter of Professor Hickson of the University of Manchester shall support the cause of Agricultural Zoology more strongly ; "Insects and insects alone do not give a sufficiently wide out-look. Some knowledge of other animals particularly Nematoda, Arachnida, Worms and Protozoa for agriculture students should form a part of their equipment..... .....In my opinion such a course is essential in any Scientific Agricultural Education. No Agricultural College can ever reach a second or even third-rate rank without it."

Library.—The entomological section of the College Library has continued to grow, but many more periodicals are required to make it really suitable for first rate research work. I aim at making the entomological section of the Agricultural College a centre for research in pure and Applied Entomology. As there is no place in the Punjab where conditions necessary for entomological research exist, it is therefore our duty to foster as best as we can, this important branch of Zoology. A really first rate, up-to-date library is the first essential condition for original work. One can make a working bench out of packing

cases and incubator out of an old tin, but it is not possible to replace books by anything else. We have received great help from the libraries outside the Punjab in our work and I have to acknowledge with thanks the courtesy shown to us by the Director, Zoological Survey of India, and the Director of the Agricultural Research Institute, Pusa, in lending us books and periodicals. This system of borrowing books from such distant places is not without disadvantages. The stimulus of a new discovery must be perpetuated by further action along that line, and often, very often, absence of literature deadens that stimulus, and although one may be able to get the information one wants, yet the rapidity with which one gets what is desired, accelerates his actions. Those who have experienced passion for research can well understand this.

Laboratory.—No additions have been made in the laboratory accommodations. The University Commission have commented on the available room for the practical laboratory. As far as accommodation is concerned the laboratory is too small for teaching work and too inadequate for research. Expansion is urgently needed. In its equipment it has come quite up to the mark.

Insectory.—We are still without an insectory and the need for it is being felt more and more keenly every day. Insect breeding is impossible without a proper place where temperature, humidity, etc., can be controlled. Failures in our breeding experiments, which are the direct outcome of our not having a proper insectory, are very disheartening.

Research.—The investigations carried out during the year are dealt with briefly in the following pages. Besides the work mentioned therein, research in some branches of pure Entomology has also been carried out. Sardar Hem Singh Pruthi, Assistant Professor of Entomology, is engaged on "The study of Genitalia of some Rhynchota," which promises to be interesting. I spent my recess this year in studying "Spermatogenesis in *Poecilocerous pictus.*" I believe that investigations on pure science are essential to keep up the enthusiasm for scientific methods of research and search after truth for its own sake. "For teaching purposes," says Prof. Lefroy, "one must . . . . be prepared to give a good deal of time to general Entomology." And as we are a teaching, as well as a research institute, we must, to a certain degree, pursue pure science to keep us fresh in our views.

Mr. Muhammad Fazal, an M. Sc. student from Government College, Lahore, has been given permission to do research in our laboratory. He is now working out the anatomy of *Xylocopa* under our guidance.

Publications.—The following papers were contributed by the Entomological Section to the Fourth Entomological Meeting, held at Pusa, during February 1921 :—

(1) Winter sprays against 'Tela' of mango gardens in the Punjab.

(2) Preliminary observations on the control of field rats.

(3) Preliminary observations on the lethal temperature for the larvæ of *Trogoderma Khapra*, a pest of stored wheat.

(4) Observations on the oviposition and life-history of Microbracon, parasite of the cotton bollworm.

(5) Citrus Psylla and its control.

The first four of these papers will be published in the Proceedings of the Entomological Meeting which is in the press.

The following papers were read at the last session of the Indian Science Congress, held at Calcutta :—

(1) Problems of parasitism in Applied Entomology. (The paper will be sent for publication in the Indian Agricultural Journal.)

(2) Spraying in the Punjab.

(3) Biology and Morphology of Red Cotton Bug.

(4) Parthenogenesis in the Braconidæ. The paper on "Citrus Psylla and its control" is ready for the press and will be submitted for publication as a memoir of the Agricultural Research Institute, Pusa.

Material for a paper on "Parasites of *Earias Insulana*" is ready for publication.

Propaganda.—In my report for the year 1919-20 I took the opportunity of discussing, at some length, the necessity of propagada work in popularising Applied Entomology. During the year under review practical steps were taken to demonstrate to the general public the aim and scope of Applied Zoology. The work was started in earnest and a set of attractive show cases was prepared illustrating, by means of coloured diagrams and actual specimens of the insects, the life-histories of pests and the nature of damage. Explanatory notes written in easy language were added to the above. Full instructions for the control of pests have also been added to these show cases. The exhibits include the following :—

(1) The Cotton Bollworms.

(2) Parasites of the cotton bollworms.

(3) The Sugar-cane Moth-Borers.

(4) White Ants.

(5) Aphis and their enemies.

(6) Pests of cotton.

(7) Pests of fruit trees.

(8) Vegetable pests.

(9) Citrus Psylla.

(10) Pests of stored grains.

(11) Pests of mangoes.

(12) Fruit Flies.

(13) Hairy Caterpillars.

(14) Silkworm rearing, etc.

(15) Insect-eating birds.

These artistically arranged show cases were mainly the outcome of the combined efforts of Messrs. Dina Nath and Umrao Bahadur. Besides these a set of spraying machines samples of insecticides and repellents, rat traps, etc., were exhibited, and those interested were, as far as possible, explained the uses of various things. Actual living insects, chiefly pests were shown to the visitors. The attractiveness of the exhibition was increased by a number of very interesting and instructive cartoons, invariably portraying a prosperous farmer of some bulk who had followed the instructions of the department and had gained success against the insects ; and a wretched-looking man, much reduced in cubic capacity, who had shown carelessness in not following the advice given gratis. A magnificent gate (in keeping with the spirit of Entomology) was designed to give the whole show a more orthodox appearance.

The exhibition is made portable and was taken to the following places :—

1. Kapurthala– at the invitation of the Director of Agriculture, Kapurthala.
2. Jullundur cattle fair.
3. Muktsar cattle fair.
4. Hoshiarpur, on the occasion of the Sikh Educational Conference.
5. Lyallpur at the time of the cattle and horse fair.

Judging from the number of people that invaded the Entomological exhibition at every occasion and the interest they took in everything there, and the questions they asked, we might safely say that our demonstrations were highly appreciated. At Muktsar over 6,000 people visited the exhibition and were explained the mystery of insect life, and its importance to the agriculturists.

We have prepared a number of lantern slides illustrating the life-histories of insect pests, and hope to add this form of instruction to our exhibitions We should aim at making this branch of our section more elaborate, and it is highly desirable that more money be spent on it and a special staff sanctioned to enable us to visit every fair and gathering in the Punjab. It is also proposed that steps should be taken to employ cinematograph for this purpose. I saw a cinematographic demonstration at Calcutta and have already reported on this. If we can move the ducational authorities and take in hand the production of films in conjunction with that department, the question of getting sufficient money which, I believe, is the only hindrance, will be solved. Cinematograph is used very extensively in some countries for purposes of spreading knowledge amongst the masses. It is used in some countries for the training of rearers for silkworms. The life-like demonstrations make a great impression on the mind of the populace.

It was chiefly in connection with sericulture that propaganda work was most intensive. A demonstration in rearing silkworms was started at the Museum, Lahore, and lectures were delivered by Assistants and Mokaddams, who went out to enlist rearers.

II.—Entomological.

Cotton.---The cotton crop in the colony suffered from some physiological causes, as last year ; and in some places this failure was attributed to bollworm attack. The percentage of bollworm attack, in the colony and at other places was, in majority of cases, normal and below normal, and nowhere was it found to be serious.

Table showing the percentage of bollworm attack in cottons in the colony.

Date.	Desi.			American.		
	Total number of bolls counted.	Bolls attacked.	Percentage of attack.	Total number of bolls counted.	Bolls attacked.	Percentage of attack.
1920 June	2,693	71	2·6	4,287	88	2·5
,, July	3,336	134	4·0	2,054	54	2·1
,, August	2,132	293	13·7	3,667	234	6·3
,, September	2,393	147	6·3	3,076	109	3·5
,, November	4,775	345	7·2	7,835	489	6·2
,, December	1,098	149	13·5	1,858	220	11·8
1921 February	84	1	1·1	219	20	9·1

Table showing the percentage of bollworm attack in other parts of the province.

Locality	Date.	Desi.			American.		
		Total number of bolls.	Bolls attacked.	Percentage of attack.	Total number of bolls	Bolls attacked.	Percentage of attack.
Sargodha	June	43	3	6·9	30	1	5·5
Hansi	July	1,785	171	8·4	264	36	13·6
(Ratoon crop)	,, ...	585	19	3·4	593	23	4·0
Rohtak (Ratoon crop) ...	,, ...	110	14	12·7	76	7	5·2
Hansi	August	149	14	9·4	...	...	...
Jullundur	September ...	1,477	55	4·0	272	9	3·3
Hansi	,, ...	3,081	73	2·3	1,106	52	4·7
(Ratoon crop)	,, ...	1,131	39	3·4	...	...	...
Jullundur	October	368	15	4·0	...	...	...

Careful examination of the cotton fields was made to discover how the bollworm passes its winter and the following facts have been ascertained after a series of observations:—

The cotton crop in the fields provides food for the bollworms till about the middle of January, after which the plants dry up and only very few green bolls are to be seen. Bollworm caterpillars have been observed feeding on such bolls till about the beginning of February. The moths that emerge in January and February have to search for some other food plants to lay their eggs, and in some cases when there are no malvaceous plants near about, eggs are deposited on dry cotton sticks. Of course, the caterpillars from these eggs have to starve in absence of food. Some moths succeed in finding *Sida cordifolia*, a malvaceous weed generally found in the fields, and lay their eggs there. Only one generation feeds on this weed. Some moths, specially those from the fields near gardens, etc., go to the hollyhock, a common garden plant, and start laying eggs there. It is the brood from this lot that is mainly responsible for the attack on coming cotton crop.

The above facts lead us to believe that in the Punjab there is no stage in the life-cycle of the bollworms when it hibernates, but goes on breeding and feeding throughout the year. This is remarkable because of the extremes of temperature in this province. The development is however very much prolonged in winter and the life-cycle occupies as much as 116 days as against 28 days in summer. At this time of the year the bollworm caterpillars are attacked by various bacterial and fungoid diseases, and this factor together with the severe winter, reduces considerably the numbers of this pest in the fields. In January and February only very few bollworms are observed in the fields. These few caterpillars can be further reduced by destroying cotton sticks left over after the last picking. Complete removal of the cotton plants after the last picking and destruction of the malvaceous plants from the cotton growing area is sure to reduce the bollworms considerably.

Attempts were made to attract *Earias insulana* moths to different vegetable extracts and mixtures, but no definite results have so far been obtained.

Cardboard sheets smeared with treacle were dragged in cotton fields to catch bollworm moths and six moths were thus caught one evening in ten minutes. This requires further trials and might prove to be very effective method of catching the moths in large numbers, when they are abundant in the fields.

During the year under report a very large collection of the bollworm caterpillars was made from various fields at Lyallpur and the surrounding villages and from some other localities of the province. These were reared in the laboratory and the extent of parasitization was studied.

Table showing the extent of parasitization in bollworms.

Month of collection.	Number of *Earias insulana* moths emerged.	Parasites.					
		M. lefroyi.	Yellow Braconid.	Chalcids.	Trachanid flies.	Big brown Braconid.	Black chalcid on cocoon.
April	19	...	...	..	...	...	...
May	85	...	2	2	...	...	...
June	114	...	...	1	...	...	...
July	250	6	...	4	...	...	..
August	155	...	1	1	...	1	3
September	171	...	...	1	...	2	...
October	183	...	14	13	3	1	...
November	215	...	7	13	...	...	1
December	926	5	27	3	1	...	...
January	73	...	...	...	...	...	...
Febrrary	60	...	1	8	...	1	...
March	25	...	...	...	...	...	...
April	23	...	...	...	...	...	...
GRAND TOTAL ...	2,099	11	52	51	4	5	4

It will be evident from the above table that the percentage of parasitization has been very low this year.

Table showing the difference in parasitization of Earias insulana *during the last two years.*

Year and month.	Number of parasitic larvae.				
	Number of bollworms bred.	*M. lefroyi.*	Yellow Braconid.	Chalcid.	Trachanid flies.
1919.					
November-December	350	24	38	75	47
1920.					
November-December	1,141	5	34	16	1

During the year under report *Microbracon* specimens were very rare at Lyallpur. Specimens were, however, collected from the parasite breeding plot at Hansi and from cotton fields at Rohtak and Jullundur. The parasite boxes supplied by us during the year were prepared from the material collected from the above places.

We have still to work out the distribution of *Microbracon* in the province during the different parts of the year.

Early in September 1921 experiments were started to find out the rate of multiplication of bollworm and its parasite, *Microbracon lefroyi*. For this purpose big muslin cages were erected in the field of American cotton at the botanical area. Each cage enclosed 10 cotton plants. Very elaborate experiments were designed to show—

(1) the rate of multiplication of bollworm ;

(2) the rate of multiplication of bollworm in presence of its parasite ;

(3) the effectiveness of the parasite when the bollworm has become very bad.

Unfortunately we could not see the results of these experiments, because the muslin was removed from the cages by some one who thought that it could be more usefully employed elsewhere. These experiments would have given us some very interesting data. This shows how essential it is to have an insectory and proper field cages to avoid re-occurrence of such misfortunes.

Along with the above-mentioned observations in the fields, experiments were carried out in the insectory to breed different parasites of bollworm, special attention being paid to *Microbracon lefroyi* and yellow braconid—the parasites of *Earias* caterpillar—and the big brown braconid—the parasite of *Earias* cocoon. These experiments were first started under, as far as practicable, natural conditions. The adult parasites were liberated in large gauze cages measuring 18″ × 18″ × 24″, each containing a fresh cotton twig attacked by a known number of bollworm caterpillars. In spite of the fact that observations were repeated on a very large number of parasites, our attempts were not successful. The number of parasites liberated in these cages was :—*Microbracon* 180, yellow braconid 39, Chalcid 48, Trachanid files 20.

Observations were restarted in July 1920 and continued in October and December under completely artificial conditions and some important facts were recorded. A paper dealing with the " Observations on the oviposition and life-history of *Microbracon lefroyi* " was read at the last Entomological meeting held at Pusa during February. This paper gives a detailed account of our experiments.

Similar observations have been made on the yellow braconid—an internal parasite of the caterpillars, and the big brown braconid—a parasite of the cocoons, of *Earias insulana*. A summary of the life-cycle is given in the following pages.

Microbracon lefroyi.—The female parasite, fertilized or unfertilized, oviposites on the body of the host soon after emergence. Generally the full grown caterpillar is selected for oviposition, but sometimes a bollworm caterpillar in 4th instar is also attacked. Unfertilized females produce only males. The largest number of eggs deposited on a caterpillar left overnight in the same dish with the parasite was 19, and the largest number laid during the day in October was 30. Exact number of eggs laid under natural conditions is still not known, but the largest number obtained in the insectory was 219. This was during October and from an unfertilized female. The following table would show the number of eggs laid by the different females in the insectory :—

Table showing the daily rate of oviposition of Microbracon lefroyi.

Date of oviposition.	NUMBER OF EGGS DEPOSITED BY THE FEMALES.									
	No. 1.*	No. 2.	No. 3.	No 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.
July 6	4	...	...	...	...	...	...	...	...	...
6-9	16	...	...	...	...	...	...	...	...	...
9-10	4	...	...	...	...	...	...	...	...	...
10	3	...	...	...	...	...	...	...	...	...
10-12	16	...	...	...	...	...	...	...	...	...
12-13	10	E	...	...	...	...	...	...	...	...
13	16	...		...	...	...	..	...	...	...
13-14	4	...	...	...	...	...	...	...	...	...
14	8	...	...	...	..	...	...	...	...	...
16	D	12 A	...	...	...	...	...	...	...	...
17	...	...	E	...	...	...	...	...	...	...
19	...	...	16	...	...	...	...	...		...
21	...	...	4 F	..	...	...	...	...	...	...
August 5	...	...	...	E	E	...	...		...	...
6	...	...	...	...	...	E	...	...	...	...
7	...	...	...	1	1	...	...	...	...	...
8	...	...	...		4	4		...		...
10	...	...	...	2	D	9	...	...	...	...
11	...	...	...	3	...	...	...	...	...	...
12	...	...	...	11	...	F	...	...	...	...
13	...	...	...	D	...	...	...	..		...
October 2	..	...	...	...	...	...	E	E	E	E
3	...	...	...		...	...	4	7	..	4
4	...	...	...	...	...	...	14	8 D	6	20
5	...	...	...	...	...	...	17	...	17	23 F
6	...	...	...	...	...	...	7	...	17	...
7	...	...	...	...	...	...	9	...	20	...
8	...	...	..	...	...	...	7	...	24	...
9	...	...	...	...	...	...	2 D	...	21	...
10	...	...	...	...	...	...	...	...	28	...
11	...	...	...	...	...	...	...	...	30	...
12	...	...	...	...	...	...	...	...	27	...
13	...	...	...	...	...	...	..	...	11	...
14		...	...	...	...	...	...	...	14	...
15	...	...	...	...	...	...	...	...	4	...
16	...	...	...	...	...	...	...	...	D	...
Total number of eggs laid.	81	12	20	17	5	13	60	15	219	4

Note :—A Denotes accidentaly killed.
D „ died.
E „ date of emergence.
F „ escaped.

*Female No. 1 was caught from fields on 6th July.

Eggs are laid on the outside of the body of the host, singly or in groups of 2 to 6 or more. They are usually laid on the ventral side of the caterpillar in the region of the abdomen, but might be laid on any other part of the body. The grubs come out after about 24 to 26 hours.

The grub.—The newly hatched grub is creamy white in colour, the contents of the intestine show through its transparent body wall. The head, compared to the body, is very large. The grub crawls about the body of the host and begins to suck the juices when it finds a suitable place. It usually sticks to this place till it is full fed. The full grown grub is more or less spindle shaped, being thickest in the middle. Internal structures are seen through the transparent body wall. The grub stage occupies 32—37 hours in August, 67 hours in October and more than 10 days in December.

Pupa.—The full grown grub leaves the host to pupate. It prepares a silken white cocoon and pupates within it. In some cases, however, the grub pupates " openly," but such cases are not common. Pupa when fresh is white, but it soon develops a reddish tint in certain parts and the general colour of the pupa becomes yellow. The duration of the pupal stage also varies with the climate. In summer it is 5-6 days while in winter it takes 27 days.

The Imago.—As the duration of the different stages of the parasite is prolonged during winter, the life of the adult is also much prolonged. So far, we have not been able to get eggs from the adults that emerged in January, though vigorous attempts had been made since last two seasons. Probably the adult hibernates in winter and starts egg laying, when conditions become favourable, but the point requires further investigations before anything definite can be said about it.

Conclusions.—Ever since 1905—the year of the failure of the cotton crop in the Punjab *Rhogas lefroyi* has been said to be the most effective parasite of the bollworm and is said to destroy a very large proportion of this pest during normal years. It was therefore suggested that we should attempt to help nature by increasing the number of these parasites, and consequently the use of parasite boxes was advocated. There has, however, been difference of opinion as to the real efficacy of this parasite against the bollworms. Our investigations have brought to light certain significant facts which might be mentioned here.

So far as is known *Microbracon* (Rhogas) is free from enemies and it lays a sufficiently large number of eggs. It, therefore, has great possibilities of rapid multiplication. The life-cycle of *Microbracon* takes at most 10 days in summer as compared to 30 days of *Earias* and assuming that a female *Microbracon* lays only 100 eggs, only 50 of these develop into females, and assuming on the other hand that the bollworm lays 500 eggs, 50 per cent. of which develop into females, and further assuming that in both cases other factors are the same, the progeny of one pair of *Microbracon* will be able to kill off the progeny of 500 pairs of *Earias* in 30 days. Theoretically, therefore, probabilities of checking *Earias* by the use of this parasite seem to be within the range of possibility. Detailed investigations are however necessary, and are being carried out.

The Yellow Braconid.—This is an internal parasite and therefore not so easy to study. Eggs are laid inside the body of the bollworm caterpillar. From a large collection of the pupæ of this parasite made from fields, it was observed that the bollworm in third stage is mostly attacked. In the laboratory this observation was confirmed. In captivity some nearly full-grown caterpillars were also attacked. The full-grown grubs of the parasite are white and thick in structure, and occupy the whole of the body of the host. It pupates inside the skin of the *Earias* caterpillar.

The adult parasite comes out of pupa by biting a circular hole at the posterior end of the skin of the host. The female starts the work of laying eggs from the very day it comes out. Virgin female gives rise to progeny which are all males. The largest number of worms stung in the insectory by one female " yellow braconid " was eight from 7th February, when the female emerged, up to 22nd February when it died.

This parasite, though very commonly met with in the fields from September to April does not appear to be as effective as *Microbracon lefroyi* because of the small number of worms stung, and the small number (sometimes even one) of eggs laid on one host. However before rejecting it, further investigations must be carried out to ascertain its efficacy.

Big Brown Braconid.—This parasite has commonly been met with flying about in the gardens and fields and is of fairly large size.

At Lyallpur we get it from December to April and also in July, September and December. It has also been collected from Jullundur in August and Hansi in August and September from cotton and hollyhock.

Egg.—The female parasite stings through the cocoons of *Earias insulana* and the eggs are laid inside on the pupa. The process of stinging in this particular case has been observed to be very long and in one case, while making observations on oviposition, the female parasite was seen stinging the cocoon for as long as 67 minutes without laying any eggs on it. The exact number of eggs laid is so far not known, and would only be possible when we have our own field cages. In the present insectory three females laid 9, 4 and 11 eggs during October, December and February, respectively.

The female parasite attacks worms and pupae of *Earias* which lie inside the cocoon. A full grown caterpillar which has not yet spun a cocoon is not attacked. The time taken in the egg stage is one day during October, four days in March and five days in January. Besides the above, observations were continued on the life-histories of the chalcid and tachinid parasites on Earias worms, and chalcids parasites on *Earias* cocoons.

A large number of *Earias insulana* eggs—300—were collected from cottons and hollyhock during February to April to get some egg parasites, but this year no parasite was obtained from the large collection made at Lyallpur.

There was no bollworm report from outside and only eight parasite boxes were supplied to Sub-Divisional Officer, Abchar. Some living specimens of *Microtracon* were sent to R. L. Pendleton, officiating Director of Agriculture, Gwalior, for his experiment.

Mango hopper.

Idiocerus atkinsoni and *I. clypealis*.—(Jassidæ, Rhynchota) are the two most serious pests of mango inflorescence in the Punjab. Both these insects pass some 345 days of a year in the adult stage. In summer they are commonly seen congregating on the underside of the horizontal basal branches of the trees, and during winter they conceal themselves in the cracks and crevices of the bark. In the beginning of spring, when blossom appears, they move to the inflorescences, and about the third week of February, the females begin to lay eggs in the floral buds. The nymphs hatch out within two or three days of oviposition, *i.e.*, about the same time as the flowers open. During the last season the nymphs were met with for the first time on the 3rd of March and the adults on the 20th April. The adult hoppers are very susceptible to captivity. During the year under report about 30 attempts were made to bring these insects from Lahore to Lyallpur for breeding experiments, but invariably most of them died during the first few hours of their captivity. This was not due to the deficiency of air in the cages, because their sides were either of very fine muslin or of gauze with wide meshes, nor was it the result of the absence of food, as fresh inflorescences were provided after short intervals. A few adults however reached Lyallpur and some pairs were sleeved on mango trees in the College compound. From 7 of these sleeves we obtained 20—25 nymphs each. This number however does not indicate the egg-laying capacity of the female. Experiment will be repeated next year to determine the number of eggs that a female can lay. To determine the number of generations of this pest in a year, young nymphs were put in sleeved inflorescences. In 12 of them, they grew into adults to both sexes ; therefore, in every sleeve both males and females were present, but there was no further reproduction this year. This shows that there is only one generation in a year.

Rearing was done in the Laboratory as well with the following results :—

i. The nymphs become adult after undergoing 5 moults.

ii. Each individual takes about 18—20 days to reach maturity.

The nymphs begin to suck the juices of an inflorescence as soon as they appear, with the result that all the flowers wither and the tree either bears no fruit or the fruit, if set, fall very early.

As is well known *tela* is responsible for enormous losses. During the year under review reports received from Deputy Commissioners of Ambala, Lahore, Gurdaspur and Hoshiarpur, show that this pest on an average was responsible for the destruction of 40 per cent. of the fruit. This is a very low estimate as compared with the attack of this pest during previous years.

Killing these insects by means of spraying presents great difficulties. The nymphs, as has been said above, appear at the same time as the blossom. An insecticide strong enough to kill them is also liable to injure the flowers. And during summer the adults are too active to receive a sufficient shower of the insecticide to kill them. During the last season a careful study of the habits of this pest was made and we arrived at the conclusion that the best time for killing these insects was during the winter mornings. The low temperature during the early hours of a winter morning is severe enough to make all insects inert and very reluctant to hop or fly. It was therefore decided to take advantage of this fact and spraying operations were started. We sprayed with ordinary hand machines, which are not suitable for spraying high trees. In spite of the difficulties the results obtained were very encouraging. Mango trees in a garden near Bhagwanpura (Lahore) were treated with various insecticides, such as rosin wash, fish oil, rosin soap, Macdougal's fluid, sanitary fluid, soap, crude oil emulsion, and tobacco decoction. It was found that an insecticide having rosin or resin as one of its constituents was very effective, because it made the sluggish hopper stick to the trees. Solignum or crude oil mixed with rosin proved the most effective.

The formulæ of the insecticides are :—

i.	Rosin	...	2 seers.
	Sodium carbonate	...	1 seer.
	Solignum	...	2 seers.
	Water	...	25 gallons.

ii. Resin ... 2 seers.

Soda ... ½ seer
Crude oil ... ½ seer } or crude oil 2 seers.
Solignum ... 2 seers

Water ... 25 gallons.

On an average about 10 gallons of water were required per tree. The average cost of insecticide per tree works out at about Re. 0-7-0.

The effect of the winter spray was at once evident from the number of hopperst hat died. To get an idea of the percentage of the hoppers killed, counts of the living and dead hoppers were made soon after the spraying. The number of the hoppers killed was from 52—90 per cent. The results of countings are given in statement No. 1 attached.

It is interesting to mention that the garden under experiment had not borne any fruit for 1917 to 1919. In 1920 when the Entomological section sprayed some trees, it bore fruit and was leased for Rs. 500. This year (1921) after the winter spraying it has been leased out for Rs. 4,700. Thus the money realised in this year is about nine times of what was realised last year. The statement No. 2 (attached) of the sale prices of seven gardens near Bhagwanpura for the last five years is given below. This shows that in the case of all the gardens except the one sprayed by us, increase, on an average, is only two times. Taking that this increase is the result of good fruiting during this year, the marked increase in the garden under experiment is undoubtedly the result of spraying.

One more point is worth noting. On comparing garden under experiment (No. 1) with Shalamar (No. 2), both of which had very good yield in 1916, we see that while garden under experiment has recovered its price of 1916, the Shalamar falls very short of it. A mantid-praying insect *Humbertiella indica* Sauss. was noticed to be devouring hoppers at a very rapid rate. Unfortunately the number of these useful insects is very small to caues very great destruction in the numbers of *tela*.

Statement No. 1—Showing the percentage of hoppers that died after spraying.

Observation No.	Date.	Insecticide.	Period during which hoppers were counted.	Number of dead hoppers seen.	Number of living hoppers seen.	Percentage of dead hoppers.	REMARKS.
1	21st December 1920	Rosin and crude oil emulsion.	2 hours...	245	25	88 %	Many of the dead hoppers were washed down on the ground so the percentage of the dead insects should be higher than the one shown here.
				180	30	89 %	
2	22nd December 1920.	Rosin and sanitary fluid.	25 minutes	140	30	85 %	
				118	24	75 %	
				92	12	89 %	
3	13th January 1921...	Rosin and crude oil emulsion.	25 ,,	200	90	92 %	
4	14th January 1921...	Rosin and Solignum	30 ,,	404	61	87 %	
			30 ,,	260	19	93 %	
			30 ,,	257	65	75 %	
			30 ,,	147	34	78 %	
			30 ,,	63	50	48 %	
5	15th January 1921...		...	297	30	92 %	
				198	95	73 %	
				92	32	66 %	
6	17th January 1921...	Rosin and crude oil emulsion.	25 minutes	32	11	75 %	Trees very small.
			25 ,,	32	13	76 %	
			25 ,,	33	14	76 %	
			25 ,,	61	11	75 %	
			25 ,,	40	19	66 %	

Statement No. 2, of sale price of the garden under experiment and seven other gardens in the neighbourhood.

Serial No.	Name of the garden.	1916.	1917.	1918.	1919.	1920.	1921.	Increase in the sale price in 1921 from 1920.	Remarks.
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.		
1	Garden under experiment.	4,300	...	...	...	500	4,700	About 9 times	The figures ware obtained for us by Mr. Ijaz Ahmad, a student of the College. He took these figures (from 2—8), from the registers of Courts of Wards.
2	Shalamar garden ...	7,000	...	170	2,600	1,350	2,800	2 times	
3	Kachcha bagh ...	Records not available.	...	415	690	500	1,325	3 times	
4	Dharyal bagh ...	Do.	...	250	550	580	1,050	2 times	It is interesting to note that while garden under experiment has recovered its value almost completely (compare yield for 1916 and 1921). Shalamar garden has brought only half of its income daring 1916. While comparing the income from various gardens it should be borne in mind that prices of an commodities including mangoes have gone up.
5	Nulipur bagh ...	Do.	..	...	1 700	1,250	1,800	½ time	
6	Nullanwala bagh ...	Do.	...	15	615	450	1,230	3 times	
7	Nagarkhana bagh ...	Do.	...	10	...	210	305	1½ times	
8	Shah Niwaz near Nali	Do.	...	...	4,000	...	1,900	..	

Euphalerous citrii.—Reports of the attack of Citrus Psylla were received from *Gujranwala, Sargodha, Jhelum and Rawalpindi.* Spraying was very effective. It seems that this pest is spreading rapidly in the citrus orchards of the province.

At Lyallpur the nymphs of the last stage were found to be very heavily parasitised by a chalcid *Tetrastichus sp.* Nov. It is chiefly in the last nymphal stage that the egg of this parasite are laid and the parasitisation may be as high as 97 per cent. of the nymphs, of this stage. The following table shows the amount of parasitisation in the beginning of January 1921 :—

Date.	Locality.	Number of parasitised nymphs.	Number of nymphs not parasitised.	Percentage of parasitism.
January 1921	Jail Gardens, Lyallpur.	138	I & II, III & IV stage stage 88. 9.	Nymphs in fourth stage 97 per cent. Nymphs in all stages 58 per cent.

The details of life-history of this insect and its control measures have been thoroughly worked and shall be submitted for publication as a Memoir of the Agriculture Department, Pusa.

Aphidæ.—Repots of the injury done by the Aphids were received from various jail gardens (Lahore, Gujranwala, Dharamsala, and Rawalpindi). The crops attacked were chiefly vegetable crops such as mangold, cabbage, cauliflower, and coriander (*dhania*). Spraying with sodium carbonate was quite effective.

Parasites.—Investigations on parasites of the pests were continued. The parasites of the cotton bollworms received special attention. A large collection of the various parasites of *Earias insulana* has been sent to the Director of the Imperial Bureau of Entomology for identification.

Some interesting facts showing the efficacy of the parasites in checking pests in nature were discovered. It was found that the chalcid parasite of *Citrus Psylla* was responsible

for the destruction of 97 per cent. of the nymphs in the gardens round about Lyallpur. It is probably through the agency of this insect that citrus psylla, which is so bad in other parts, has not given so such trouble to the fruit growers here. The parasite has been identified as *Tetrastichus ps.* Nov.

A large collection of the caterpillars of *Euproctis fraternata* was made at Jullundur in October 1926. Out of the 40 caterpillars only 10 emerged as moths and the rest gave an abundance of parasites. The parasites included Braconidæ, Chalcidæ and Tachinidæ.

Miscellaneous.—It seems that there is a general impression amongst the people that the Entomological section of the Agricultural Department is responsible for the destruction of every kind of noxious animal, from pigs, porcupines and rats, to wasps, bees and ticks. During the year under report measures against a number of formidable insects were taken in hand. The wife of a member of the staff applied for help against the honey-bees, which had taken their abode in the chimney of a staff bungalow, and started paying not infrequent visits to the drawing room. Use of "poisonous gases" was suggested, and a "smoky" fire soon drove away the enemies.

Either the wasps *Vespa orientalis,* commonly known as the *Kabuli* wasps, were too common during the last year or, as seems more likely, our propaganda work has been too intensive, with the result that we received some 20 complaints against these stinging insects from Lyallpur alone. The remedial measures that proved very effective consisted in destroying, after dusk, by spraying with some ordinary contact poison, the sentinels at the opening of the nest, and then closing this with mud after putting in a few pellets of potassium cyanide. A control experiment proved that mere closing of the opening of the nest with mud was not effective. The wasps, if they could not find a hole, soon made a way out by means of their strong mandibles. It must be borne in mind that potassium cyanide is a deadly poison; and that wasps can sting.

The poultry at the farm Gurdaspur were badly infested with lice and ticks. Birds were treated with a powder which proved very efficacious. It was, however, difficult to kill the ticks which were hiding under the cement of the hen houses, in spaces between the joints, etc. The best remedy is change of locality.

Study of the food of birds could not be taken in hand for want of staff. A few occasional observations have, however, been recorded.

Monophlebus, ordinarily known as *Ghadhari*, although a pest of plants sometimes becomes an equally bad 'pest' of human beings. At Kinnaird College for girls they made the life of the students very uncomfortable. In countless numbers they invaded the sitting rooms. They dropped from the ceiling of the dining room into the dishes and by no means improved the flavour of the food. They did not even respect the secrecy of the bed rooms. Thorough spraying and banding proved successful.

Stored Grain.—The investigations of the problems of the safe storage of grain were carried out along two different lines. In the first place experiments were started on "hermetical sealing" of grain in large earthen and glass vessels. Professor Dendy maintains that "the method of air-tight storage seems likely to prove extremely valuable whenever large quantities of grain have to be stored for long periods especially in warm climates." His experiments show that sealing a grain store 'hermetically' kills off, within a short time, all stages of the insects attacking it, and makes further infection impossible.

The ideas underlying Professor Dendy's experiments are based on the methods in vogue in India, Natal and other countries. The farmers in Natal use large iron tanks for storing maize. The tanks are filled almost up to the brim and candles are allowed to burn in the tanks until the air is exhausted. The tanks are then securely closed. Thus stored, the grain is known to resist the ravages of the weevils for a very long time. In India also wheat can be successfully stored in round bins and underground pits if these are without insects. If the efficacy of air-tight storage is established we may have to introduce the crude methods of the past in the most up-to-date elevators. Experiments started to confirm Professor Dendy's results have not yielded any definite data. Twelve flasks, of the cubic capacity of 60 c.c., were completely filled with wheat of different types, inoculated with 10 male and 10 female larvæ of *T. khapra,* and closed "hermetically" by dipping the corked mouths into melting paraffin. Twelve similar flasks were similarly treated but the mouths were only closed by cotton wool; these flasks were to serve as controls. Unfortunately insects died in all the 24 flasks. The experiments are being repeated in bigger flasks and in earthen pitchers variously treated to make them air-tight. It might be mentioned that Professor Dendy experimented with *Calandra oryzæ,* while the insect under our observation has been *T. khapra* (larvæ only).

The second line of investigation was to find out the effect of superheating on the insects of the stored-grain. The larvæ of *T. khapra,* which are notorious for their tenacity, were selected. The results of our experiments were embodied in a paper, "Preliminary observations on the Lethal Temperature for the larvæ of *Trogoderma khapra,* a pest of stored wheat," read at the Fourth Entomological Meeting held at Pusa. The larvæ of *T. khapra* are not killed if subjected to a temperature below 52° C. (125° F.). A temparature above this proves fatal, but the lethal effect depends on the time of the exposure. Higher the temperature, shorter

the time required to kill the insects. The results of our experiments have been briefly summarised in the following table :—

Number.	Temperature (Centigrade.)	Duration of exposure.	Effect of exposure.	Final effect.
1	50·51	5 hours	Motionless	Living.
2	52	90 minutes	,,	Dead.
3	53	30 ,,	,,	,,
4	54	20 ,,	,,	,,
5	56	420 seconds	,,	,,
6	58	300 ,,	,,	,,
7	61	180 ,,	,,	,,
8	69	90 ,,	,,	,,
9	71-77	60 ,,	,,	,,
10	78-84	45 ,,	,,	,,
11	85-100	30 ,,	,,	,,

Superheating as a remedy against pests of stored-grain is coming into general use, and we shall have to resort to this method.

Experiments on fumigation were carried out at the wheat godown at Convillpur (Montgomery). A detailed note has already been submitted. Superheating was also tried and it proved as effective as CS_2 and HCN gas and was far less expensive.

The Elevator.—The grain elevator at Lyallpur was originally designed to keep wheat stored in it free from weevil attack. It has not, however, proved a success in this respect. Mechanical cleaning to which wheat is subjected before storage does not remove every stage of the harmful insects from the grain. The inevitable result is that, very soon after storage, weevilling sets in. Mechanical cleaning only removes dust and dead insects, and might throw out the adults, but such insects or their larvæ as enter the grain, usually reach the bins with the grain. At any rate the eggs glued to the surface of the grain or lodged in its substance cannot be eliminated. Hence the inefficiency of this method of cleaning grain.

After the wheat is run out of a bin the signs of the attack become quite apparent. Innumerable insects can be seen crawling inside the bins and round the mouth. A careful examination of the bin showed a large number of the larvæ of *T. khapra* and adult *Rhizopertha dominica* hiding in the crevices in the cement. Every little depression provided shelter to more than one larva of *T. khapra*. We experienced very great difficulty in cleaning the elevator of these hibernating larvæ. The building has been designed without taking into consideration the necessity of fumigating it. The following features in its construction are very objectionable :—

(1) The building does not yield itself to fumigation or superheating as it cannot be made air-tight.

(2) The holes in the cement and spaces in the masonry provide shelter to the larvæ and make it impossible for any spraying liquid to reach them.

(3) There is no satisfactory arrangement for cleaning the bins. The top manholes are too small, and it is not possible to remove all the insects from the corners of the bins.

(4) The whole of the wheat in a bin does not run out and the quantity that remains sticking to the walls, in the corners, and at the bottom of the cone provides a very suitable breeding ground for the pests.

We treated a few bins with carbon bisulphide, some with hydrocyanic acid gas and a few were superheated. We also tried spraying. The lower part of the elevator had to be sprayed (as it cannot be made air-tight and is too open for any other operation except spraying). The cost of fumigating a single bin of the cubic capacity of 11,338 cubic feet with CS_2 was Rs. 72. In all cases the insects in the bins treated were killed. This was judged from the fact that insects suspended in the bins in small muslin bags were found to have died after the operations. In the case of the elevator also the process of superheating gave very encouraging results.

From the fact that the wheat stored in the newly erected elevator was weevilled, we concluded that infested wheat was brought in. This was confirmed by actual observations this year. This is a very dangerous practice and should be put a stop to. All the money spent in cleaning the elevator, and all the energy spent in killing the insects is wasted if after a few days infested wheat is run in. We must arrange to fumigate or superheat all the grain before it is run into the elevator.

III.—Zoological.

Rats.—Reports were received against this pest from every corner of the Punjab—Sargodha, Chillianwala, Sialkote, Muzaffargarh, Gurdaspur and Hoshiarpur.

The population of this fast-breeding pest in India is enormous and Major Kunhardt's estimate of 800 millions seems to be quite modest. It was observed that a rat on an average eats about 1 chhattak of wheat per day, hence, even on the basis of the above estimation of its population, this pest causes an annual loss of 9,125,000 maunds of grain, worth about Rs. 45,62,50,000. The Punjab contributes a fair share of this total.

Rat feeds on all sorts of food available. It destroys grain at every stage—in the stock, grainary, bins, mill, as well as grain that has been sown and is germinating. It takes to its burrow anything edible or otherwise that comes in its way. During the year under report, among other things, soft cotton, silk and cotton cloth, paper, etc., were recovered from their homes. We have to deal with the pest not only in the field, but also in silkworm huts. This pest is proving very dangerous to the silk industry. This year we received complaints from almost all the rearers that their worms were being eaten by rats (this in spite of the fact that arsenic was supplied).

For want of sufficient staff remedial operations against this animal were taken in hand only at a few places. Of the numerous poisons tried, strychnine, arsenious acid and plaster of Paris have proved to be very effective. These poisons were mixed with a suitable bait in the following proportions :—

Strychnine	...	½ chhatak or arsenious acid 4 chhataks or plaster of Paris 8 chhataks.
Sugar	...	2 seers.
Gram	...	15 seers.

The following steps were taken in poisoning rats. All the rat burrows were closed one day previous to the day of poisoning. Those found reopened next morning were taken to be inhabited. A small quantity of the poisoned bait was put in each burrow which was subsequently closed. If it remained closed till next morning, its occupant was taken to be dead.

With the aforementioned three poisons, 60—90 per cent. of the rat burrows remained closed. Strychnine was the most effective, but it has the disadvantage of being fatally poisonon-to domestic animals and human beings. This bait should be very carefully handled and placed deep down in the burrow. The cost of poison by means of this bait was one anna for 8 burrows (excluding the cost of labour). With plaster of Paris and arsenious acid, about 75—80 per cent. of burrows remained closed and the cost was one anna for 15 burrows.

In the statement given below are detailed the observations on the efficacy and cost of different poisons (Statement 3).

It may be emphasized that nothing is possible without organisation. We should arrange for campaigns against this pest on an extensive scale, and for this co-operation amongst the people themselves and the people and the members of the Agricultural Department is essential. It will not serve any purpose to kill rats in a field or so. Work of extermination should be done on large areas at the same time and in an organised manner. District authorities must take interest. It should be arranged in the following manner. A tahsil should form the unit of organization Three days (1st, 2nd and 3rd) in every month should be set apart as "rat days". On the first day all the zamindars should close the rat burrows in their fields ; and in every village the poisoned bait should be prepared under the supervision of the head Lambardar. On the 2nd, when the holes occupied by the rats will be reopened, the bait should be carried in carts in the four directions and the zamindars should put the bait in the burrows. On the 3rd the rats if dead outside, should be collected and burnt or buried. Evidently on all three days the rat work will take only a few hours, but this small amount of organized work will keep them in check.

Organized campaigns against this pest have been carried out in other countries for many years.

In these days of scarcity of food material, we must fight against this pest—dangerous enemy of mankind—in an earnest manner.

Statement No. 3 showing observations on the efficacy and cost of different poisons.

Poison.	Date.	Place.	Number of burrows present.	Number of burrows presumably occupied by rats and in which poison bait was put.	Number of burrows out of (5) that remained closed.	Number of burrows out of (5) that re-opened and was closed again without putting anything in them.	Number of burrows out of (7) that remained closed.	Total Number of burrows that remained closed.	Number of dead rats found outside the burrows.	Percentage.	Amount of cost.	Area in acres.	Average cost.	Control.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
											Rs. A. P.				
1. Strychnine ...	21st December 1920	Rakh Pindi Jalol, Hafizabad.	2,465	1,750	1,126	589	344	1,470	62	86 per cent.	13 4 0	350	One anna for 8 burrows 8½ pies per acre.	Fifty burrows were closed without putting any bait in them. They were closed for successive 3 days. The rats reopened them every day, none left due to disturbance.	
2. Strychnine ...	1st December 1920	Chillianwala	920	781	534	197	57	591	34	80 per cent.	0 13 0	250	One anna for 6 burrows 7½ pies an acre.	Three out of 25 burrows were found closed on 3rd day of disturbance.	
3. Strychnine ...	25th November 1920	Sargodha ...	168	123	108	15	7 not closed.	108	10	90 per cent	0 13 0	200	Ten burrows for 1 anna.	Occupants of 2 out of 23 left their home on the 4th day of disturbance.	
4. Strychnine ...	14th November 1920	Lyallpur ...	168	32	84	24	20	28	3	96 per cent	0 4 6	6	Seven and-a-half burrows for one anna.	...	
5. Strychnine ...	21st November 1920	Lyallpur ...	168	190	165	25	1	173	10	90 per cent.	1 6 0	10	Nine burrows for one anna.	...	
6. Plaster of Paris ...	13th January 1921	Chak 432, Lyallpur.	85	41	22	19	13	35	3	87 per cent.	0 7 0	10	Fifteen burrows for one anna.	Ten burrows. No burrow deserted.	
7. Plaster of Paris ...	21st January 1921	Lyallpur	85	57	40	17	5	45	3	82 per cent.	0 7 0	10	Ditto ...	...	
8. Arsenious acid ...	15th December 1920	Rakh Pindi Jalol, Hafizabad.	85	45	5	40	10	15	2	33 per cent.					
9. Arsenious acid pills in flour	27th November 1920	Chillianwala	85	21	10	11	1	11	4	51 per cent.					
10. Arsenious acid on grains .	16th December 1920	Lyallpur ...	85	130	80	50	21	101	4	77 per cent.	0 4 0	10	Eleven burrows for one anna.	Fifteen burrows ; one deserted due to disturbance.	
11. Arsenious acid on grains...	15th January 1921	Chak 432, Lyallpur.	85	25	18	7	2	20	2	80 per cent.					
12. Barium carbonate pills ...	27th November 1921	Chillianwala ..	...	48	20	22	8	28	3	56 per cent.					
13. Barium carbonate on grains.	15th December 1920	Lyallpur ...	...	30	145	16	4	18	...	60 per cent.	0 7 6	...	Fifteen burrows for one anna.	Ten burrows ; none deserted	
14. Barium carbonate on grains.	16th December 1920	Lyallpur ...	4	27	11	16	5	16	2	61 per cent.					
15. Sulphur fumigation ...	27th January 1921	Lyallpur ...	72	24	17	5	...	17	...	7 per cent.	0 6 0	...	Between 10 and 11 burrows for one anna.	One burrow deserted on 2nd day, 2 burrows on 3rd day.	
16. Sulphur fumigation ...	21st January 1921	Lyallpur ..	...	40	31	9	...	81	...	76 per cent.					

IV.—Sericulture.

Progess in sericulture has been remarkably rapid. During 1921, the Entomological Section distributed 1,762 ounces of silkworm eggs as against 600 ounces during 1920. (Sh. Ghulam Sadiq distributed 388 ounces as against 400 last year.)

Silkworm rearing was done in 16 districts as against 8 in 1920, in 28 tahsils as against 15, in 120 villages as against 54 last year. The total number of rearers was 490 as against 131 last year, thus 359 new rearers were trained during the year under review. (See statement No. 4).

For the next year arrangments have been made to distribute 3,000 ounces of seed.

The last season was a very bad season for silkworm rearing. The various factors contributing towards this were :—

(*i*) The hatching of seed received from France was very poor. A separate report was submitted discussing the probable causes of this failure. These may be summarised as—

(*a*) a short period of hibernation ;

(*b*) influence of unequal temperature during the transport of seed from France to India.

(*ii*) The season was a fortnight too early and the seed was kept for incubation a little later. It was therefore impossible to avoid the hot winds during end of March.

(*iii*) The very high temperature during March and the first week of April killed the worms when they were about to spin. (See graph of maximum temperature for Sialkot, page 70.)

(*iv*) Scarcity of rains had influenced the growth of the leaves. Very few leaves were produced and those present were hard.

The highest yield per ounce was 12 seers of dry cocoons. The average yield per ounce of seed was only 2 seers. If it were not for the above causes, the average yield would have been at least 10 seers. The total produce brought for auction was 35 maunds and 20 seers. (In addition to this, yield from 131 ounces was reeled by the rearers themselves.)

Price realised differed according to the quality of the cocoons. For the cocoons of the first quality the price obtained was Rs. 230 and Rs. 226, for those of second quality the price was Rs. 210 and for the third quality Rs. 200 per maund. (The total yield of 388 ounces reared by Sheikh Ghulam Sadiq was 9 maunds and 20 seers.)

Prize competitions and auctions were held during May at Gurdaspur and Zafarwal Prizes to the value of Rs. 349 were distributed amongst the successful rearers.

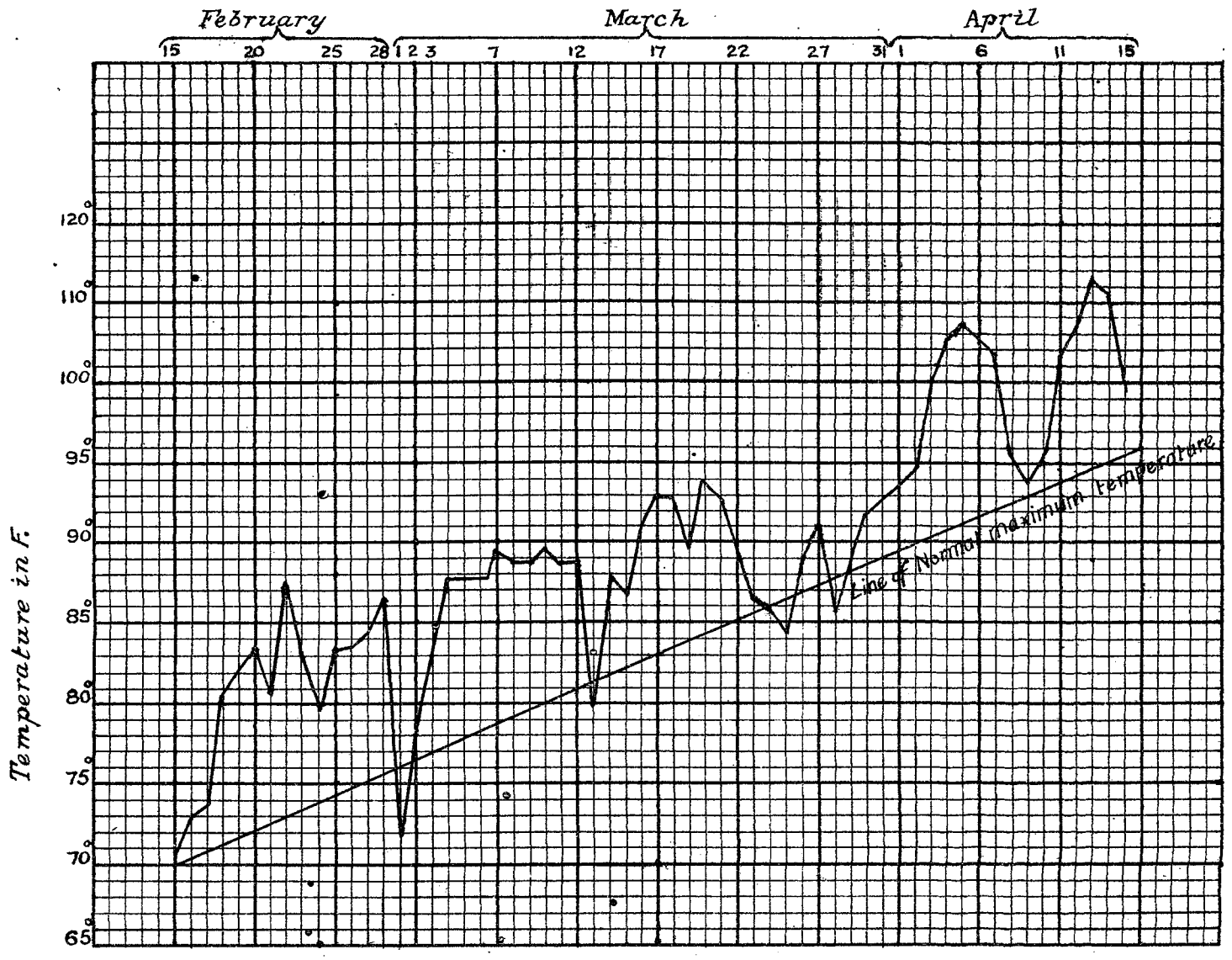
Grainage was attempted on a small scale and cocoons for this purpose were selected from amongst those reared by the rearers. The high temperature at the time of spinning produced a very poor crop and we were not able to select really first class cocoons. The moths were examined at Kasauli. This examination showed that Pebrin was not very prevalent in the Punjab ; not more than 1 per cent. of the moths were pebrinized.

A special sericulture class was started in the college. Almost all the students of the college and the members of the Rural Economy Class attended our lectures. Practical training was given to some 50 students. The Entomological Laboratory was used for rearing. It is essential that a small rearing hut is built.

Arrangements were made to exhibit silkworm rearing in all its stages at the Museum, Lahore. I acknowledge with thanks the help given to us by the Curator of the Museum in making this exhibition a success. From the number of visitors that attended the exhibition and from the letters I have received, I am inclined to believe that our experiment was a great success. I hope that many more such exhibitions shall be arranged for next year.

The staff for Mulberry Plantations was transferred to the Agricultural Department from the Department of Industries, and was placed under the Entomologist from 1st March 1921. A nursery has been established near Sujanpur, and plantations started along the Upper Bari Doab Canal. (A detailed report has already been submitted)

Sayed Zahid Hussain, Jagirdar of Batala, offered his services for sericulture, and he was appointed Honorary Sericulture Assistant for one year from 23rd March 1921. He has done very useful propaganda work and has enlisted a large number of rearers for the next season. He has chiefly worked in Campbellpur and Jhelum districts. The Deputy Commissioner, Campbellpur, has spoken highly of Sayed Zahid Hussain's enthusiasm.


February
March
April
15 20 25 28 1 2 3 7 12 17 22 27 31 1 6 11 15
120° 110° 100° 95° 90° 85° 80° 75° 70° 65°
Temperature in F.
Line of Normal maximum temperature

Curve of daily maximum temperature
from 15th Feb: to 15th April 1921, at Sialkote.

Statement No. 4 showing sericultural operations in the Punjab during 1921.

Districts.	Seed distributed by the Entomological section.													Seed distributed by other agencies.			Remarks.
	Tehsils.			*Village.*			*Rearers.*			Amount of seed.	*Schools.*			Wasdev Singh.	Ram Lal Kotu Mal.	Sheikh Ghulam Sadiq.	
	Old.	New.	Total.	Old.	New.	Total.	Old.	New.	Total.		Old.	New.	Total.				
Gurdaspur ...	4	...	4	18	9	27	56	79	135	646 ozs.	11	2	13	158	210	282	Figures about the rearers and their villages, etc., of private agencies are not available.
Hoshiarpur ...	1	1	2	6	16	22	22	115	137	286½ ozs.	8	...	8	...	...	...	
Sialkot ...	2	2	4	9	6	15	35	21	56	90 ozs.	9	11	20	...	...	...	
Shahpur ...	3	...	3	9	8	17	5	71	76	90 ozs.	1	...	1	...	...	...	
Amritsar ...	...	...	...	...	...	...	...	...	...	...	2	...	2	133	...	106	
Kangra ...	1	1	2	4	15	19	4	43	47	67 ozs.	...	...	...	...	...	...	
Ambala ...	2	...	2	6	1	7	7	5	12	24½ ozs.	2	...	2	...	...	..	
Rawalpindi ...	..	1	1	...	3	3	...	10	10	10 ozs.	...	...	...	...	...	...	
Miscellaneous	2	8	10	2	8	10	2	15	17	29 ozs.	...	...	...	...	...	...	
Grand Total	15	13	28	54	66	120	131	359	490	1,243 ozs.	33	13	46	291 ozs.	210	388	

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PART II—EXPERIMENTAL WORK AT LYALLPUR AGRICULTURAL STATION.

Mr. Roberts held charge until 25th February when he resigned his appointment and handed over to Mr. Faulkner. On 11th April Mr. Faulkner left Lyallpur to proceed to England en route for Nigeria where he had been appointed Director of Agriculture. I took over from him on that date and held charge for the remainder of the year.

Except for the year 1915-16 when the total rainfall was only 3·04 inches, the year under report was the driest on record. The total rainfall was 6·05 inches as compared with 9·89 inches during the previous year, 8·85 inches as an average for preceding five years, and 13·94 inches average for the last ten years. As will be seen from statement I, except for 0·16 inch during December, January and February there was no rain from September till June. This had a very marked detrimental effect on both Rabi and Kharif crops.

SUGARCANE.

(a) *Varietal tests.*—Varieties tested were Suretha, Lalri and Katha, the latter being the variety most commonly grown in the Chenab Colony. Statement II shows the results obtained. From these it will be seen that Suretha on one plot gave the record of 86 maunds 26 seers 8 chhitaks Gur per acre, whilst the average yield of all plots was 82 maunds 14 seers 8 chhitaks. Lalri gave a highest yield of 73 maunds Gur per acre and an average on all plots of 69 maunds 7 seers 4 chhitaks. Against these the local variety Katha gave a highest yield of 70 maunds 15 seers 11 chhitaks and an average of 65 maunds 3 seers 11 chhitaks. It will thus be seen that Suretha gave an average of 17 maunds 10 seers 13 chhitaks and Lalri 4 maunds 3 seers 9 chhitaks more than the local variety. During the past two years Suretha has given consistently higher yields on all plots than Katha.

On the tenants' area the results obtained confirm those of the farm (see statement III). Here the averages, though lower than those on the farm, are in the same order of merit.

	Mds.	*Srs.*	*Chs.*	
Suretha	57	33	8	Gur per acre.
Lalri	49	9	0	„ „ „
Local	46	24	15	„ „ „

There seems little doubt that Suretha can be very safely recommended where land is good and irrigation can be somewhat commanded. Even on poorer land, as in sq. 13-8 (statement III) Suretha did better than other varieties. Even though in one case the weight of stripped cane was lower in its case than in local variety, 44 maunds 10 seers as against 45 maunds 17 seers yet its yield of Gur was higher than that of katha by approximately 4 maunds per acre.

Experiments have been started to test Suretha against Katha both with frequent and few irrigations.

(b) *Cultural experiments.*—As sugar cane receives more interculture than any other crop, and up to the present this has all been performed by hand labour, the experiment was tried this year for the first time of planting the rows wide apart in order to be able to use bullock labour and implements. The local custom is to plant the rows about 15 inches apart and this was tried against 27 inches apart. The results are given in statement IV and may be summarised thus.

	Mds.	*Srs.*	*Chs.*	
Local variety sown 15″ apart	56	31	0	Gur per acre.
„ „ „ „ 27″ „	49	8	12	„ „ „
Suretha „ „ 15″ „	78	31	0	„ „ „
„ „ „ 27″ „	65	2	8	„ „ „

Hence in neither variety was the result of wide planting and bullock cultivation so good as the old system of narrow planting and hand labour. The results obtained in one year are not sufficient to form any conclusions on and the experiment is being continued and improved upon.

WHEAT.

Throughout the wheat season the weather was very dry and therefore white-ants appeared very early. Hence the first irrigation was given almost a month earlier than usual. There was no rust but wheat did not make good growth owing to dryness of the weather. Again as the wheat was ripening very hot dry weather set in and as a result the grains were much shrivelled. These factors account for the low yields obtained this year. More waterings could have been given but as cultivators in the colony can only give two or three waterings

our conditions were kept as near theirs as possible so that our results may be obtained as nearly as possible under " Zamindari " conditions.

The following are the various experiments :—

Variety tests.

Punjab 8-A *v.* Punjab 11.

These tests were conducted as in previous years on a large scale, there being 86 plots of 8-A and 86 plots of 11. They were divided into early and late sown, each with two and three waterings, on good land and on lightish soil, and were done both on our new area and on tenants' area.

(A) On new area (Statement V).

(1) *Early sown (i.e., beginning of November) with three irrigations.*—Nine plots were under Punjab 8-A and nine under Punjab 11. Of these in five cases Punjab 11 was the better and in four cases Punjab 8-A. On the average 8-A was the better, the yields of grain per acre being :—

	Mds.	*Srs.*	*Chs.*
Punjab 8-A	26	26	13
Punjab 11	25	32	3
	34		10

Superiority of Punjab 8-A was thus 34 seers 10 chhitaks.

(2) *Early sown with two irrigations.*—Of six trials of each Punjab 11 was the better in two cases and Punjab 8-A in four.

On the average 8-A was the better by 10 seers 1 chhitak. Average yields were :—

	Mds.	*Srs.*	*Chs.*
Punjab 8-A	19	14	14
Punjab 11	19	4	13

Late sown [beginning of December] (Statement VI).

(1) Three irrigations.

Of nine plots under each variety Punjab 11 did better in four cases and Punjab 8-A in five. On the average Punjab 11 was slightly the better by 12 seers per acre.

Yields—

	Mds.	*Srs.*	*Chs.*
Punjab 8-A	11	23	9
Punjab 11	11	35	9

(2) Two irrigations.

Of nine comparisons Punjab 11 was the better in 4 and Punjab 8-A in 5 cases. On the average Punjab 11 did better by less than 5 seers.

Yields—

	Mds.	*Srs.*	*Chs.*
Punjab 8-A	7	26	10
Punjab 11	7	31	7

(B) Tenants' area.

(*a*) 1. *Early sown on good land. Three irrigations.*—Eight tests of each were made. In four cases Punjab 11 was the better and in four Punjab 8-A. Average of all plots shows Punjab 11 the better by 30 seers (Statement VII).

Yields—

	Mds.	*Srs.*	*Chs.*
Punjab 8-A	26	1	5
Punjab 11	26	31	5

2. *Early sown on good land. Two irrigations.*—Of eight tests of each, four were in favour of Punjab 8-A and four of Punjab 11. On average the difference was 5½ seers in favour of Punjab 8-A (Statement VIII).

Yields—

	Mds.	*Srs.*	*Chs.*
Punjab 8-A	20	9	11
Punjab 11	20	4	3

(*b*) 1. *Early sown on light land. Three irrigations.*—Here Punjab 11 was the better in three cases, Punjab 8-A in four, and in one they were equal. Average gave Punjab 11 a superiority of 23 seers (Statement IX).

Yields—	*Mds.*	*Srs.*	*Chs.*
Punjab 8-A	17	33	6
Punjab 11	18	16	5

2. *Early sown on light land. Two irrigations.*—Punjab 11 was the better in two cases and Punjab 8-A in four. On average there is a difference of $2\frac{3}{4}$ maunds in favour of Punjab 8-A (Statement X).

Yields—	*Mds.*	*Srs.*	*Chs.*
Punjab 8-A	17	20	13
Punjab 11	14	30	6

(*c*) 1. *Late sown on good land. Three irrigations.*—Punjab 11 was better in four tests and Punjab 8-A in three and on average Punjab 11 was the better by 14 seers (Statement XI).

Yields—	*Mds.*	*Srs.*	*Chs.*
Punjab 8-A	16	36	12
Punjab 11	17	10	12

2. *Late sown on good land. Two irrigations.*—Of six trials three were in favour of each and on average Punjab 11 was the better by just over one maund (Statement XII).

Yields—	*Mds.*	*Srs.*	*Chs.*
Punjab 8-A	14	38	0
Punjab 11	15	39	3

(*d*) 1. *Late sown on light land. Three irrigations.*—Out of six plots Punjab 11 was the better in five and on the average Punjab 11 was the better by $2\frac{1}{2}$ maunds. (Statement XIII).

Yields—	*Mds.*	*Srs.*	*Chs.*
Punjab 8-A	14	35	6
Punjab 11	17	19	2

The great difference here is largely due to one plot which showed a difference of $5\frac{1}{2}$ maunds due to some local condition.

2. *Late sown on light land. Two irrigations.*—Six plots under each, Punjab 11 the better in four, and Punjab 8-A in two cases. Average is in favour of Punjab 11 by 1 maund 28 seers. (Statement XIV).

Yields—	*Mds.*	*Srs.*	*Chs.*
Punjab 8-A	14	32	11
Punjab 11	16	10	1

Summary.—Out of a total of 87 tests, 43 were in favour of Punjab 8-A and 44 in favour of Punjab 11. The total area under each was $18\frac{3}{4}$ acres, and the average yields of each show a balance in favour of Punjab 11 of 13 seers 4 chittaks.

Average yields were—

	Mds.	*Srs.*	*Chs.*
Punjab 8-A	17	27	9
Punjab 11	18	0	13

So far as the actual weight of grain produced is concerned there is little to choose between the two varieties. The balance in favour of Punjab 11, though small, is consistent with the results obtained in previous years. Yet the fact that Punjab 8-A produces more bhusa than Punjab 11 must not be lost sight of especially in seasons such as the present when bhusa is very scarce and dear.

Punjab 17 versus *Punjab 8-A.*—Of seven plots tried three were in favour of Punjab 17 and four of Punjab 8-A. The average gave 8-A a superiority of 19 seers. (Statement XV).

Yields were—

	Mds.	*Srs.*	*Chs.*
Punjab 8-A	17	38	11
Punjab 17	17	19	11

Punjab 11 versus *Howard's N H₄ × P₆* —In all cases Punjab 11 had a very marked superiority. (Statement XVI.)

Average yields were—

	Mds.	*Srs.*	*Chs.*
Punjab 11	33	22	0
N H_4 × P_6	23	2	10

Irrigation experiments with wheat.

(*i*) *Early sown.*—Two irrigations against three (Statement XVII).

The average is in favour of three waterings by over 2½ maunds of grain.

Average yields were—

	Mds.	*Srs.*	*Chs.*
Two waterings	20	9	12
Three waterings	22	32	8

(*ii*) *Late sown.*—Two irrigations against three (Statement XVIII).

The average here is very markedly in favour of three irrigations by almost seven maunds of grain.

Average yields were—

	Mds.	*Srs.*	*Chs.*
Two waterings	12	33	4
Three waterings	19	22	4

The marked advantage of three waterings of late sown wheat this year is due to the abnormally hot weather towards the ripening stage. The third watering helped to prevent the grain shrivelling.

Cultural Experiments.

Hot weather cultivation versus *Rain ploughing.*

Treatment.	Yield of grain per acre.		
	Mds.	*Srs.*	*Chs.*
Hot weather cultivation	9	17	7
Rain ploughing	13	10	5

The difference of almost 4 maunds in favour of rain ploughing confirms the results of last year and shows the superiority of this system of cultivation (Statement XIX).

Harrowing versus *Non-harrowing.*

	Mds.	*Srs.*	*Chs.*
Harrowed plot	37	17	6
Non-harrowed plot	39	12	10

As will be noticed a higher yield was obtained where no harrowing was done. It may be noted that harrowing just after sowing only was done. It could not be done after first irrigation as the crop had grown too high. In two plots (Statement XX) the yields will be seen to be 41 maunds 17 seers and 41 maunds 9 seers. These results are marvellous in view of the unfavourable season and are no less an achievement than the record yield of 43 maunds last year when the season was favourable.

Manurial Experiments.—Nitrate of soda (Statement XXI).

Manure per acre –

	Mds.	*Srs.*	*Chs.*
1½ cwts.	8	8	0
1 cwt.	7	24	0
No manure	6	28	0

It will be seen that nitrate of soda at the rate of 1½ cwts. per acre gives an increase of 1½ maunds but this increase does not justify the cost of manure. All the yields here are very poor as the land is " Kalrathi ".

Green manuring with Guara early and late.—(Statement XXII).

" Early " means Guara sown 9th May 1920 and ploughed in 23rd August 1920.

"Late" means Guara sown 1st July 1920 and ploughed in 14th September 1920.

	Mds.	*Srs.*	*Chs.*
Early	16	24	7
Late	16	29	2
No manure	18	30	1

As will be noticed Guara both early and late had a depressing effect on the yield. Possibly this may be due to the dry season not permitting the proper decay of the manure. Nothing definite can yet be said as on the Students' farm an increase has been obtained in the yield through the application of this manure. The experiment will be continued.

Statement XXIII shows an improvement in yield by the application of Guara ploughed in, to the extent of almost 3 maunds of grain per acre. This is borne out by the result obtained in the tenants' area (Statement XXIV) where the yield of grain rose through the application of Guara from 16 maunds 25 seers to 22 maunds 32 seers per acre.

Statement XXV gives a comparison of the effects of ploughing in San and Guara and of growing Guara, but removing it and not applying to the wheat—

	Yield per acre.		
	Mds.	*Srs.*	*Chs.*
San ploughed in	15	22	0
Guara „ „	13	29	0
Guara removed	12	28	0

The harmful effect of growing Guara before the wheat crop and removing it, is indicated by the lower yield of 1 maund per acre. This is much less than in previous years.

Effect of lime.—(Statement XXVI).

Whilst the application of 14 maunds of lime per acre increased the outturn of grain by one half maund, this result would not cover the extra expenditure incurred.

Residual effects of manures on wheat.—Manures had been applied to the previous maize crop. The greatest effect was obtained from the nitrate of soda plot with a yield of 21 maunds per acre. Farmyard manure gave 18 maunds 25 seers and the complete manure 17 maunds 26 seers whilst the control was under 8 maunds (Statement XXVII).

The experiment in Statement XXVIII has just been started this year. The land is under a cropping scheme of intensities varying from 66 per cent. to 166 per cent. No conclusions can be drawn for some years.

COTTON.

From the very beginning of the growing season, cotton plants made very small vegetative growth owing to the dryness of the year. At the time of flowering and fruiting there was also a scarcity of rain and though the flowering was good the fruit did not set well. Except where the water supply was good the opening of the bolls was decidedly poor and in many cases the seed did not mature properly in the case of American cottons.

The yields were, therefore, on the whole low and the quality poor—

Varietal Experiments. 4-F versus *285-F.*

(*a*) With frequent waterings, Eight (Statement XXIX).

The results were—

	Mds.	*Srs.*	*Chs.*	
4-F	8	31	12	On heavy loam.
285-F	7	31	14	
4-F	6	21	12	On medium loam.
285-F	10	34	0	

(*b*) With few waterings, Four (Statement XXX).

4-F	3	12	4	Loam.
285-F	4	16	5	
4-F	3	38	12	Heavy loam.
285-F	4	38	14	

The results may be interpreted by stating that on heavy land with a plentiful supply of water the balance is in favour of 4-F, whilst on lighter soils and poor water supply 285-F does best. These results confirm previous tests. The difference of 4 maunds in case of medium soils with heavy watering is not reliable as in that case the test was only on two sets of plots.

The row to row tests in Statement XXXI confirm the general results in the previous statements

(*c*) *4-F* v. *4-F selection No. 1.*—The selection was made two years ago. Last year the balance was somewhat in favour of the selection, but this year the original 4-F did better by about 6 seers on the average. (Statement XXXII).

(*d*) *4-F* v. *Special stray No.* 2.—The seed of the variety which we have here called Special Stray No. 2 was obtained from a plant in last year's crop. This plant differed from the others in appearance and in having longer lint. The results obtained are not very favourable for the selection (Statement XXXIII).

(*e*) *4-F* v. *Mollisoni 24.*—The results here are decidedly in favour of Mollisoni 24 by over 3 maunds, due to a large extent to the season being bad for American Cotton (Statement XXXIV).

(*f*) *G. I. Mollisoni 24* v. *G. sanguineum.*—Broadleaved (Farm selected).

In all cases, total of eight plots, Sanguineum was the better by an average of 1 maund 31 seers (Statement XXXV).

(*g*) *G. N. Rosea 87-1* v. *G. I. Mollisoni 24.*—The results obtained show both about equal (Statement XXXVI).

Irrigation Experiments.—The results shown in Statement XXXVII are what would be expected in a dry season, *viz.*, liberal irrigation early in the season materially increases the yield. In normal seasons in previous years it was seen that first irrigation could be delayed safely till beginning of July. Statement XXXVIII confirms this.

Irrigation after and before the flowering stage (*Statement XXXIX*).—Results shown in statement XXXIX are somewhat in favour of frequent irrigations after flowering but the yield is very poor throughout owing to bad land.

The results of early waterings in the tenants' area do not show much harmful effect in delaying the first irrigation (Statement XL).

Cultural Experiments.—In shallow *versus* deep ploughing the results are slightly in favour of deep ploughing (Statement XLI).

In flat *versus* ridging experiments there is little to choose so far as actual yields go butthe saving of water effected should not be lost sight of. The very miserable yields are here again due to bad land (Statement XLII).

On the tenant's area the results obtained were similar to those on the farm (Statement XLIII).

The results of Line sowing *versus* Broadcast sowing show nothing convincing (Statement XLV).

TORIA.

Varieties (Statement XLV).—The work on selection of toria and on early and late varieties was continued. The results do not show so large a difference as last year but on the whole "Early" is better than "Late" by 20 seers.

The effect of harrowing was variable, in some cases non-harrowed plots giving higher yield than harrowed and *viee-versa*. On the average of all plots, the non-harrowed yields 20 seers per acre more than the harrowed. Though non-harrowed on the average gave the higher yield, the harrowed plots all looked much better throughout, but especially in the early stage.

Local Toria v. *Early Raya No. 3.*—As will be seen from Statement XLVII our selection Early Raya No. 3 gives great promise, for whereas the average yield of the local Toria is 15 maunds 20 seers the selection gave 22 maunds 28 seers.

As the oil content of Raya No. 3 is at least as good as that of toria and the quantity 1½ times as much, this selection holds out hopes of a real improvement in this line. Larger scale trials will now be carried out.

Harrowing and non-harrowing, Local Toria on the tenants' area.—Practically no difference was obtained (Statement XLVIII).

GRAM.

The work done on grams was a continuation of the comparison with local gram of certain selections by the Economic Botanist, Punjab. The results obtained are variable in comparison with last year and require further trial. Statements XLIX to LIII.

MANGELS.

Two varieties were tested, *viz.*, seed from Srinagar and seed from Sutton's, England. The latter gave the better result by an average of 76 maunds per acre, but the yields of both were very poor (Statement LIV). This may perhaps be explained by the

fact that this crop was sown directly after Chari, which is an exhausting crop. The season too was against it.

FLAX.

Some seed was obtained from the Deputy Director of Agriculture, Cawopore, and a small area grown. The resulting crop was quite good in appearance. Half was retted before the hot weather set in. The remainder will be done when temperature becomes lower. Scutching has not yet been done and the results are therefore not available.

MISCELLANEOUS.

During the year two tractors, a Cletrac and an Austin, were purchased. Not much work has yet been done with them, and it is hoped that when fields can be laid out in larger areas good work may be done.

Two self driven threshing mills have also been acquired. Each is worked by its own 5-6 H. P. motor and thus the trouble of lining up an engine is done away. The machines are only yet in the experimental stage with us, and no results can yet be given. We were handicapped this year by having no mistri of our own to attend to them. In connection with one of the machines there is a bhusa maker which was made after Mr. Faulkner's design. It seems to be an efficient machine and to make very satisfactory bhusa.

One self-delivery McCormack reaper has also been purchased and gave good satisfaction during the harvest. Its great advantage lay in the fact that it could continue cutting a whole field without having the wheat tied up as it proceeded, thus labour was not actually necessary at the time of cutting, and tying into bundles could be done at any time later.

H. R. STEWART.

Statement No. I.

STATEMENT SHOWING RAINFALL AT THE LYALLPUR AGRICULTURAL STATION DURING THE YEARS 1919-20 AND 1920-21.

Name of month.	Rainfall during 1920-21.	Rainfall during 1919-20.	REMARKS.
July	0·46	2·59	
August	3·07	5·17	
September	1·53	...	
October	...	...	
November	...	...	
December	0·05	0·87	
January	0·09	0·57	
February	0·02	0·21	
March	...	0·26	
April	...	...	
May	...	0·22	
June	0·83	...	
Total	6·05	9·89	

Average rainfall for the last 5 years ... ... 8·85 inches.
Average rainfall for the last 10 years ... ... 13·939 ,,

Statement No. II.

RESULTS OF VARIETAL TESTS OF SUGARCANE—SURETHA AND LALRI V. KATHA—GROWN IN ROTATION SERIES, AREA C1 SQUARE 27, KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Area in acres.	Variety of cane.	Weight of Stripped cane. Maunds.	Seers.	Chhitaks.	Green tops. Maunds.	Seers.	Chhitaks.	Dry leaves. Maunds.	Seers.	Chhitaks.	Juice. Maunds.	Seers.	Chhitaks.	Gur. Maund.	Seers.	Chhitaks.	Yield per acre of gur. Maunds.	Seers.	Chhitaks.	Percentage of Tops to cane.	Dry leaves to cane.	Juice to cane.	Gur to cane.	Gur to juice.	Number of waterings with dates.	Remarks.
27-C1	1	Acre ¼.	Katha ...	69	36	8	18	33	8	17	7	12	37	24	0	7	15	2	59	1	0	26·94	24·4	53·0	10 6	19·65		
	2		Lalri ...	73	29	0	16	25	8	13	38	8	42	30	0	8	15	8	67	4	0	22·56	18·94	57·98	11·3	19·81		
	3		Katha ...	75	15	0	14	22	0	17	28	0	43	7	0	8	1	14	64	15	0	19·30	23·48	57·28	10·67	18·63	14 waterings on — 29th April 1920. 17th May 1920. 6th June 1920. 25th June 1920. 13th July 1920. 23rd July 1920. 3rd August 1920. 16th August 1920. 30th August 1920. 12th September 1920. 28th September 1920. 12th October 1920. 3rd November 1920. 18th-19th December 1920.	Ploughings ... 3 Harrowings ... 6 Sohagaings ... 12 Bar harrowings ... 2 Hoeings. ... 5 Date of sowing 27th-28th March 1920. Date of harvesting 20th January 1921 to 19th February 1921.
	4		Suretha ...	83	13	0	11	20	0	14	30	0	50	31	0	9	30	5	78	2	8	13·80	17·7	51·23	11·71	19·21		
	5		Katha ...	72	17	0	14	8	0	16	35	0	37	26	0	7	24	2	60	33	0	19·6	23·3	51·98	10·49	20·19		
	6		Lalri ...	72	37	0	12	32	0	12	37	0	40	17	0	8	8	12	65	30	0	17·55	17·72	55·45	11·27	20 34		
	7		Katha ..	74	37	0	14	32	8	16	32	0	40	9	0	8	9	8	65	36	0	19·76	22·42	53·68	10·1	20·47		
	8		Suretha ...	88	28	0	15	36	0	16	27	0	53	12	0	10	33	5	86	26	8	17·93	18·79	60·9	12·21	20·32		
	9		Katha ...	80	21	0	13	1	0	15	24	0	43	13	0	8	31	14	70	15	0	22·38	19·37	53·8	10·92	21·3		
	10		Lalri ...	75	4	0	14	14	8	12	26	0	42	25	0	8	34	6	70	35	0	19·12	16·85	56·75	11·63	20·78		
	11		Katha ...	76	20	0	14	27	0	17	5	0	43	6	0	8	24	10	68	37	0	19·15	22·37	56 4	11·26	19·97		
	13		Katha ...	74	5	0	15	23	0	16	33	0	40	38	0	8	11	2	66	9	0	21·0	22·69	55·24	11·16	20·21		
	14		Lalri ...	76	38	8	13	18	8	14	18	0	44	15	0	9	5	0	73	0	0	17·49	18·75	57·65	11·98	20·56		

AVERAGE YIELD OF GUR PER ¼ ACRE.

	Mds.	Srs.	Chs.
Katha (7 plots) ...	65	3	11¾
Suretha (2 plots) ...	82	14	8
Lalri (4 plots) ...	69	7	4

Statement No. III.

RESULTS OF VARIETAL TESTS WITH SUGARCANE IN TENANTS' AREA AT LYALLPUR AGRICULTURAL STATION, YEAR 1920-21.

No. of square and plot.	No. of sub-plot.	Variety of cane.	Treatment.	Area in acres.	Weight of Green tops. Maunds.	Weight of Green tops. Seers.	Weight of Cane. Maunds.	Weight of Cane. Seers.	Weight of Juice. Maunds.	Weight of Juice. Seers.	Weight of Gur. Maunds.	Weight of Gur. Seers.	Yield of gur per acre. Maunds.	Yield of gur per acre. Seers.	Yield of gur per acre. Chhitaks.	Percentage of green tops to cane.	Percentage of juice to cane.	Percentage of gur to juice.	Percentage of gur to cane.	Number of irrigation with dates.	Number of hoeings with dates.	Weight of canes required to make 1 lb of gur.	Remarks.
3				7																			
17/2	1	Local cane		64/7	24	20	53	9	30	18	5	38½	54	20	9	43·57	54·15	19·58	10·60	Fourteen on— 5th May 1920, 8th May 1920, 2nd June 1920, 13th June 1920, 25th June 1920, 10th July 1920, 24th July 1920, 6th August 1920, 20th August 1920, 1st September 1920, 14th September 1920, 30th September 1920, 11th October 1920, and 23rd October 1920.	Bar harrows on 31st March 1920, and 14th April 1920. Blind hoeing on 8th April 1920. Hoeing with Kasala on 5th June 1920. Hoeing with Khurpa three on 3rd May 1920, 9th May 1920, and 25th May 1920. Sohaga on 11th April 1920.	9·43	Germination good and stand of crop also good.
	2	Lalri		64/7	21	12	55	2	32	1	5	38	54	16	0	38·69	58·27	18·57	10·80			9·25	Ditte ditto.
	3	Local		64/7	25	23	56	37	32	23	6	11 2/16	57	16	0	44·92	58·20	19·28	11·026			9·07	Ditto ditto.
	4	Suretha		64/7	26	30	64	8	38	34	7	16 10/16	67	32	0	41·66	60·51	19·08	11·55			8·65	Ditto but lodged to some extent.
13	1	Local	Manure was applied to previous maize crop.	17	20	38	42	22	23	25	4	29½	40	7	4	49·11	55·52	20·07	11·14			8·97	
8	2	Lalri		144/17	17	10	40	22	23	25	4	26	39	15	8	42·54	58·26	19·68	11·46			8·72	
	3	Local		144/17	18	3	45	17	25	39	5	3½	43	1	10	36·79	57·18	19·56	11·18	Fourteen on— 1st May 1920, 12th May 1920, 24th May 1920, 7th June 1920, 19th June 1920, 16th July 1920, 23th July 1920, 11th August 1920, 28th August 1920, 8th September 1920, 19th September 1920, 5th October 1920, 18th October 1920, and 11th November 1920.	Bar harrows 3 on 25th March 1920, 5th April 1920 and 25th May 1920. Blind hoeing on 3rd April 1920. Hoeing with Kasala 2 on 29th May 1920 and 14th June 1920. Hoeing with Khurpa on 5th May 1920. Sohaga one on 5th April 1920.	8·94	
	4	Suretha		144/17	17	5	44	10	28	35	5	25½	47	27	0	41·55	65·25	19·49	12·71			7·86	Germination good throughout except sub-plot 4 in which the germination was rather thin.
	5	Local		144/17	15	32	39	39	21	36	4	14½	36	36	0	39·50	54·78	19·93	10·92			9·15	Crop average and did not lodge.
	6	Lalri		144/17	17	9	48	20	28	28	5	25⅝	47	29	1	35·51	59·17	19·63	11·61			8·61	
	7	Local		144/17	17	36	46	30	26	33	5	5½	43	18	9	38·38	57·38	19·12	10·97			9·11	
	8	Suretha		144/17	18	10	47	34	32	2	6	11½	53	8	3	37·02	66·98	19·59	13·12			7·62	
16	1	Local		39/320	20	20	49	26	26	9	5	14	43	35	14	41·29	52·82	20·40	10·77			9·03	
14+17	2	Lalri		39/320	19	18	52	37	30	1	5	33½	48	36	14	36·75	56·73	19·85	11·26	Fifteen on— 30th April 1920, 12th May 1920, 23rd May 1920, 7th June 1920, 19th June 1920, 16th July 1920, 29th July 1920, 11th August 1920, 26th August 1920, 7th September 1920, 19th September 1920, 5th October 1920, 19th October 1920, 2nd November 1920, and 30th November 1920.	Bar harrows two on 26th March 1920, and 5th May 1920. Blind hoeing on 4th April 1920. Hoeing with Kasala two on 29th May 1920, and 13th May 1920. Sohaga one on 5th April 1920.	8·88	
	3	Local		39/320	19	22	49	5	25	35	5	33½	47	35	14	39·79	54·70	21·72	11·88			8·41	
	4	Suretha		39/320	19	29	61	2	36	19	7	16	60	20	8	32·30	59·74	20·21	12·08			8·27	Germination good throughout sub-plots 7 and 8 lodged to some extent (about 2 marlas each).
	5	Local		39/320	18	32	49	3	28	23	5	30	47	7	3	38·30	58·22	20·12	11·71			8·53	
	6	Lalri		39/320	18	11	53	14	33	37	6	31½	55	27	11	34·25	63·58	20·00	12·72			8·01	
	7	Local		39/320	22	36	57	35	30	32	6	12⅝	51	30	12	39·56	53·21	20·48	10·90			9·17	
	8	Suretha		39/320	19	35	61	8	34	7	7	12½	60	0	0	32·47	55·84	21·39	11·90			8·40	
		AVERAGE OUTTURN PER ACRE.		257/1440							54	6 32—16	46	20	5							AVERAGE OUTTURN PER ACRE CALCULATED ON YIELD PER ACRE. Mds. 46 Srs. 24 Chs. 15	
	1	Local		1697/2880							28	3 39—16	49	7	9							49 9 0	
	2	Lalri		1697/2880							34	8 16	57	28	14							57 33 8	
	3	Suretha																					

Statement No. IV.

TENANTS' AREA AT LYALLPUR AGRICULTURAL STATION, YEAR 1920-21.

Sugarcane. Hand Cultivation and ordinary Sowing *versus* Bullock Cultivation and wide sowing (2½')

No. of square and plot.	No. of sub-plot.	Variety of cane.	Treatment.	Weight of — Area in acres.	Weight of — Green top. Maunds.	Seers.	Maunds.	Weight of — Cane. Seers.	Yield of — Juice. Maunds.	Seers.	Maunds.	Yield of — Gur. Seers.	Chhitaks.	Gur per acre. Maunds.	Seers.	Chhitaks.	Percentage of green top to cane.	Percentage of juice to cane.	Percentage of gur to juice.	Percentage of gur to cane.	Number of irrigations with dates.	Number of hoeings with dates. — Narrow sown.	Sown 2½ apart	Weight of cane required to make 1 lb. of gur in lbs.	Remarks
17 / 11	1	Local ...	Narrow sown ...	½	24	31	59	1	30	26	6	18	0	51	24	0	41·97	51·08	21·04	10·92	Fourteen on— 6th May 1920.	Bar harrow— 25th March 1920.	Bar harrow— 25th March 1920.	9·15	Germination good stand good.
	2	Do. ...	Sown 2½' apart ...	½	25	8	60	6	32	30	6	14	0	50	32	0	41·89	54·44	19·38	10·55	18th May 1920	Blind hoeing and Sohaga	Blind hoeing 3rd April 1920.	9·47	Ditto.
	3	Do. ...	Narrow sown ...	½	26	9	67	38	39	10	7	29	12	61	38	0	38·59	57·76	18·13	10·47	1st June 1920.	3rd April 1920.	Sohaga Bar harrow 5th April 1920.	9·55	Ditto.
	4	Do. ...	Sown 2½' apart ...	½	26	39	62	8	28	32	5	38	3	47	25	8	43·32	46·30	20·67	9·57	12th June 1920.	Bar harrow 5th April 1920.	Horse hoe 1st May 1920.	10·44	Ditto.
	5	Suretha ...	Narrow sown ...	½	28	2	83	26	47	19	9	36	10	39	13	0	33·53	56·75	20·88	11·85	25th June 1920.	Khurpa hoeing.	Do. 9th May 1920.	8·70	Ditto.
	6	Do. ...	Sown 2½' apart ...	½	27	0	74	32	45	20	8	33	12	70	30	0	36·09	60·32	19·43	11·82	11th July 1920.	10th May 1920.	Do, 22nd May 1920.	8·45	Germination good but lodged body (about) 5
	7	Do. ...	Narrow sown ...	½	27	28	83	35	47	10	9	31	2	78	9	0	33·02	56·33	20·69	11·65	23rd July 1920.	Kasola hoeing 4th and 5th June 1920.	Do. 5th June 1920.	8·43	Do. It lodged most of all.
	8	Do. ...	Sown 2½' apart ...	½	23	5	63	15	35	23	7	16	14	59	15	0	36·48	56·13	22·04	12·37	8th August 1920. 26th August 1920. 8th September 1920. 28th September 1920. 11th October 1920. 11th November 1920 and 23rd November 1920.	Kasola hoeing on 15th June 1920.	Do. 11th June 1920.	8·08	Do. did not lodge.

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AVERAGE YIELD PER ACRE.

AVERAGE OUTTURN PER ACRE CALCULATED, ON YIELD PER ACRE.

																				Mds.	Ss.	Chs.			
1	Local cane ...	Narrow sown ...	½	...	...	...	...	...	14	7	12	56	31	0	...	...	...	...	56	31	0	...	...	9·35
2	Do. cane ...	Sown 2½ apart ...	½	...	...	...	...	...	12	12	3	49	8	12	...	...	...	...	49	8	12	...	...	9·95
3	Suretha cane...	Narrow sown ...	½	...	...	...	...	...	19	27	12	78	31	0	...	...	...	...	78	31	0	...	...	8·56
4	Do.	Sown apart 2½ ...	½	...	...	...	...	...	16	10	10	65	2	8	...	...	...	...	65	2	8	...	...	8.26

Statement

COMPARATIVE VARIETAL TESTS OF EARLY SOWN PUNJAB 8-A AND XI WITH TWO AND THREE WATERINGS

THREE WATERINGS ON 29TH NOVEMBER 1920, 2ND FEBRUARY 1921 AND 24TH MARCH 1921.

No. of square, block and plot.	No. of sub-plot.	Variety.	Area in acres.	Actual outturn per strip. *Grain.* Maunds.	Seers.	Chhitaks.	*Bhusa.* Maunds.	Seers.	Chhitaks.	Calculated yield per acre. *Grain.* Maunds.	Seers.	Chhitaks.	*Bhusa.* Maunds.	Seers.	Chhitaks.	Remarks.
32 — 1 D	1	Punjab 8-A ..		4	6	12	8	7	4	28	0	9	54	39	2	Germination good, uniform, lodging 20 %.
	2	Do XI ...		4	16	8	8	2	8	29	26	1	54	7	3	,, ,, ,, ,, 18 %.
	3	Do. 8-A ...		4	17	12	8	37	4	29	34	7	60	4	1	,, ,, ,, ,, 15 %.
	4	Do. XI ...		4	9	8	8	3	8	28	1	9	54	13	15	,, very ,, ,, ,, 18 %.
	5	Do. 8-A ...		4	17	12	8	21	4	29	34	7	57	13	3	,, ,, ,, ,, ,, 15 %.
	6	Do. XI		4	22	0	8	2	0	30	23	1	54	3	13	,, ,, ,, ,, ,, 12 %.
32 — 3 D	1	Punjab 8-A ...		3	20	8	7	6	8	23	24	3	48	5	4	Germination good, uniform, lodging 10 %.
	2	Do. XI ...	25	3	21	4	6	20	12	23	29	3	43	32	4	,, ,, ,, ,, 8 %.
	3	Do. 8-A ...	—	3	32	0	7	26	0	25	21	7	53	37	2	,, ,, ,, ,, 12 %.
	4	Do. XI ...	168	3	16	8	6	37	8	22	37	4	46	24	13	,, ,, ,, ,, 15 %.
	5	Do. 8-A ...		3	20	8	7	32	8	23	24	3	52	20	0	,, ,, ,, ,, 13 %.
	6	Do. XI		3	10	8	7	12	8	21	36	13	49	10	6	,, ,, ,, ,, 15 %.
32 — 5 D	1	Punjab 8-A ...		3	32	12	7	23	4	25	26	8	50	37	14	Germination good, more uniform, lodging 8 %,
	2	Do. XI ...		3	38	12	7	26	4	26	26	13	53	38	13	,, ,, ,, ,, ,, 10 %.
	3	Do. 8-A ...		4	6	0	8	5	0	27	35	8	54	24	0	,, ,, ,, ,, ,, 7 %.
	4	Do. XI ...		4	6	8	7	23	8	27	38	14	50	39	8	,, ,, ,, ,, ,, 12 %.
	5	Do. 8-A ...		3	34	12	7	21	4	25	39	14	50	24	6	,, ,, ,, ,, ,, 10 %.
	6	Do. XI ...		3	8	0	6	12	0	21	20	3	42	13	6	,, ,, ,, ,, ,, 8 %.

AVERAGE YIELD.

Punjab 8-A ...	225	35	28	12	71	21	4	26	26	13	53	16	6	Punjab 8-A	26	26	13	53	26	10
Punjab XI ...	168	34	29	8	66	20	8	25	32	3	50	4	5	Punjab XI	25	35	9	49	38	4

AVERAGE YIELD CALCULATED ON YIELD PER ACRE.

	Grain. Mds.	Srs.	Chs.	*Bhusa.* Mds.	Srs.	Chs.
Punjab 8-A	26	26	13	53	26	10
Punjab XI	25	35	9	49	38	4

N.B.—Superiority of Punjab 8 A to Punjab XI per acre ... ...

Mds.	Srs.	Ch.	
0	34	10	in grain
3	12	0	in Bhusa

CULTIVATION—

Raja plough	...	...
Horse hoe	...	...
Desi plough	...	...
Sohaga ...	...	...
Par Harrow	...	...

Sown on 30th October 1920 and 1st November
Harvested on 16th to 20th April.

Statement

COMPARATIVE VARIETAL TESTS OF LATE SOWN PUNJAB 8-A AND XI TWO AND THREE WATERINGS

THREE WATERINGS ON 14TH JANUARY 1921, 21ST FEBRUARY 1921 AND 17TH-18TH MARCH 1921.

No. of square, block and plot.	No. of sub-plot.	Variety.	Area in acres.	Actual yield per strip. *Grain.* Maunds.	Seers.	Chhitaks.	*Bhusa.* Maunds.	Seers.	Chhitaks.	Calculated yield per acre. *Grain.* Maunds.	Seers.	Chhitaks.	*Bhusa.* Maunds.	Seers.	Chhitaks.	Remarks.
32 — 1 C	1	Punjab 8-A ...		1	25	15	5	13	1	11	2	11	36	31	11	Germination good and uniform.
	2	Do. XI ...	25	1	33	11	3	16	5	12	14	12	22	35	10	Ditto.
	3	Do. 8-A ...	—	1	25	7	3	20	9	10	39	5	23	24	3	Ditto.
	4	Do. XI ...	168	1	24	4	2	39	12	10	31	12	20	4	12	Ditto.
	5	Do. 8-A ...		1	26	0	3	19	0	11	3	15	23	14	1	Ditto.
	6	Do. XI ...		1	26	0	2	25	0	11	3	15	17	25	10	Ditto.
32 — 3 C	1	Punjab 8-A ...		2	5	0	3	39	0	14	8	5	19	39	11	Germination good and more uniform.
	2	Do. XI ...	25	2	3	8	3	11	8	14	1	2	22	3	11	Ditto.
	3	Do. 8-A ...	—	2	2	8	3	26	8	13	34	6	24	24	6	Ditto.
	4	Do. XI ...	168	2	1	8	3	22	8	13	27	11	23	37	9	Ditto.
	5	Do. 8-A ...		1	31	2	3	20	14	11	36	13	23	26	11	Ditto.
	6	Do. XI ...		1	35	8	2	33	8	12	27	6	19	2	11	Ditto.
32 — 5 C	1	Punjab 8-A ...		1	14	14	2	34	2	9	8	12	19	6	15	Germination good and uniform.
	2	Do. XI ...	25	1	23	12	2	27	4	10	28	6	17	39	15	Ditto.
	3	Do. 8-A ...	—	1	22	12	2	37	4	10	21	11	19	27	15	Ditto.
	4	Do. XI ...	168	1	29	4	2	28	12	11	25	6	18	10	13	Ditto.
	5	Do. 8-A ...		1	27	8	3	5	8	11	13	10	21	33	10	Ditto.
	6	Do. XI ...		1	19	8	2	23	8	9	39	13	17	15	8	Ditto.

AVERAGE YIELD CALCULATED ON ACTUAL YIELD.

Punjab 8-A ...	225	15	21	2	32	21	14	11	23	9	24	12	1	Punjab 8-A ...	11	23	4	23	25	9
Do. XI ...	168	15	36	15	26	28	1	11	35	9	19	37	8	Do. XI ...	11	35	9	19	39	9

AVERAGE YIELD CALCULATED ON THE CALCULATED OUTTURN PER ACRE.

	Grain. Mds.	Srs.	Chs.	Mds.	Srs	Chs.
Punjab 8-A ...	11	23	4	23	25	9
Do. XI ..	11	35	9	19	39	9

N. B.— Mds. Sr. Chs.
Superiority of Punjab XI to 8-A is ... 0 12 0 in grain.
Inferiority of Punjab XI to 8-A is ... 4 14 9 in bhusa.

CULTIVATION—

Raja plough	1 ...	...
Horse hoe	6 ...	...
Desi plough	4 ...	...
Sohaga	4 ...	...
Bar Harrow	2 ...	...

Sown on 2-3rd December
Harvested on 23rd, 28th and 30th April

No. V.

RESPECTIVELY, GROWN IN NEW AREA, RABI 1920-21.

TWO WATERINGS ON 29TH NOVEMBER 1920 AND 25TH MARCH 1921.

No. of square, block and plot.	No. of sub-plot.	Variety.	Area in acres.	Actual outturn per strip. *Grain.* Maunds.	Seers.	Chhitaks.	*Bhusa.* Maunds.	Seers.	Chhitaks.	Calculated Yield per acre. *Grain.* Maunds.	Seers.	Chhitaks.	*Bhusa.* Maunds.	Seers.	Chhitaks.	Remarks.
32 D—2 C	1	Punjab 8-A. ...	25 / 168	3	6	0	6	18	0	21	13	2	43	13	12	Germination good, attack of white ants more. lodging 70 %.
	2	Do. XI ...		2	29	0	6	1	0	18	12	8	40	19	8	Germination good, attack of white ants more. lodging 60 %.
	3	Do. 8-A ...		3	3	0	6	2	0	20	25	10	40	26	4	,, ,, ,, ,, ,, ,, 65 %.
	4	Do. XI ..		2	39	12	6	23	4	20	4	12	44	9	1	,, ,, ,, ,, ,, ,, 60 %.
	5	Do. 8-A ...		2	1	12	6	22	4	20	18	3	44	2	5	,, ,, ,, ,, ,, ,, 55 %
	6	Do. XI ...		2	39	8	6	17	8	20	3	1	43	10	6	Germination good, lodging 60 %.
32 D—4 C	1	Punjab 8-A ...	25 / 168	2	16	10	7	2	6	16	8	13	47	17	1	,, ,, ,, 15 %.
	2	Do. XI ...		2	31	6	6	26	10	18	28	7	43	31	6	,, ,, ,, 20 %.
	3	Do. 8-A ...		2	33	8	8	15	8	19	2	12	56	14	9	,, ,, ,, 25 %.
	4	Do. XI ..		2	31	0	7	22	0	18	25	15	50	29	7	,, ,, ,, 20 %.
	5	Do. 8-A ...		2	31	0	8	9	0	18	25	15	56	38	1	,, ,, ,, 35 %.
	6	Do. XI ...		2	39	6	7	4	10	19	23	1	47	32	11	,, ,, ,, 30 %.

AVERAGE YIELD.

															AVERAGE YIELD CALCULATED ON YIELD PER ACRE.	*Grain* Mds.	Srs.	Chs.	*Bhusa.* Mds.	Srs.	Chs.
Punjab 8-A ...	150	17	11	14	42	29	2	19	14	14	47	34	4	Punjab 8-A.	19	15	12	45	5	5
Punjab XI ...	168	17	10	0	40	9	0	19	4	13	45	2	1	Punjab XI	19	9	7	45	2	1

	Mds.	Srs.	Ch.	
Superiority of 8-A to XI per acre ...	0	10	1	in grain.
,, ,, ,, ,, ,, ,, ...	2	32	3	in bhusa.

... ... 2 only
... ... 5 ,,
... ... 4 ,,
... ... 6 ,,
... ... 4 ,,
1920

No. VI.

RESPECTIVELY, GROWN IN NEW AREA, DURING RABI, 1920-21.

TWO WATERINGS ON 14TH JANUARY 1921 AND 17TH-18TH MARCH 1921 (THREE PLOTS 2, 4 AND 6 WERE WATERED ON 21ST MARCH 1921).

No. of square, block and plot.	No. of sub-plot.	Variety.	Area in acres.	Actual yield per strip. *Grain.* Maunds.	Seers.	Chhitaks.	*Bhusa.* Maunds.	Seers.	Chhitaks.	Calculated yield per acre. *Grain.* Maunds.	Seers.	Chhitaks.	*Bhusa.* Maunds.	Seers.	Chhitaks.	Remarks.
32 i—2 C	1	Punjab 8-A ...	25 / 168	1	12	14	2	33	2	8	35	5	19	0	3	Germination good and uniform
	2	Do. XI ...		1	24	0	2	5	0	10	30	1	14	11	3	Ditto.
	3	Do. 8-A ...		1	22	12	3	35	4	10	21	11	26	3	3	Ditto.
	4	Do. XI ...		1	33	8	2	28	8	12	13	2	18	8	5	Germination good and more uniform.
	5	Do. 8-A ...		1	20	12	2	39	4	10	8	4	20	1	6	Ditto.
	6	Do. XI ..		1	8	12	2	12	4	8	7	10	15	19	14	Ditto.
32 i—4 C	1	Punjab 8-A ...	25 / 168	1	3	4	2	5	12	7	10	10	13	14	14	Germination good and uniform.
	2	Do. XI ...		1	8	8	1	33	8	8	5	15	12	13	15	Ditto.
	3	Do. 8-A ...		1	10	0	4	25	0	8	16	0	31	3	3	Ditto.
	4	Do. XI ...		1	9	8	3	4	8	8	12	10	20	36	10	Ditto.
	5	Do. 8-A ...		1	10	0	2	21	0	8	16	0	16	38	12	Ditto.
	6	Do. XI ...		1	15	4	2	2	12	9	11	4	13	36	1	Ditto.
32 i—6 C	1	Punjab 8-A ...	25 / 168	1	1	4	2	13	12	6	37	3	15	30	0	This plot suffered very seriously on account of lack of irrigation. First watering was given early as the attack of white ants was serious. Moreover the crop wetted considerably, hence they yield is very poor.
	2	Do. XI ...		0	35	12	1	30	4	6	0	4	11	32	1	
	3	Do. 8-A ...		0	33	13	1	33	3	5	27	4	12	11	13	
	4	Do. XI ...		0	26	0	1	13	0	4	14	12	8	36	3	
	5	Do. 8-A ...		0	16	0	1	26	0	2	27	8	11	3	8	
	6	Do. XI ...		0	15	13	1	21	3	2	26	5	10	9	15	

AVERAGE YIELD CALCULATED ON ACTUAL YIELD :—

															AVERAGE YIELD CALCULATED ON THE CALCLULATED OUTTURN PER ACRE.	*Grain.* Mds.	Sr.	Ch.	*Bhusa.* Md.	Sr.	Ch.
Punjab 8-A ...	225	10	10	11	24	32	5	7	26	10	18	20	13	Punjab 8-A ..	7	26	9	18	29	10
Do. XI ...	168	10	17	1	18	30	15	7	31	7	16	0	11	Do. XI ..	7	28	5	14	0	7

N.B.—		Mds.	Srs.	Chs.	
	Superiority of Punjab XI to 8-A per acre ...	9	4	13	in grain.
	Inferiority of Punjab XI to 8-A per acre ...	2	20	3	in bhusa.

... ... =1 only
... ... =6 ,,
... ... =4 ,,
... ... =4 ,,
... ... =2 ,,
1920.
nd on 1st May 1921.

Statement No. VII

SHOWING THE COMPARATIVE VARIETAL TESTS OF EARLY SOWN WHEAT (TYPES 11 AND 8-A) ON GOOD LAND WITH THREE IRRIGATIONS, GROWN IN TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area.		Actual outturn of grain.			Outturn of grain per acre.			Number of irrgations with dates.	Date of sowing.	Remarks.
			Kanals.	Marlas.	Maunds.	Seers.	Chhitaks.	Maunds.	Seers.	Chhitaks.			
13 to 16	1	Pb. 11 ...	2	3	8	18	0	31	17	10	Three on— 25th December 1920, 4th February 1921 and 7th March 1921.	27th October 1920	Germination good, and crop good.
	2	„ 8-A ...	2	3	7	29	0	28	29	12		Ditto	Ditto
	3	Pb. 11 ...	2	3	8	32	12	32	32	9		Ditto	Ditto.
	4	„ 8-A ...	2	3	7	26	0	28	16	11		Ditto	Ditto.
16 to 18	1	Pb. 11 ...	2	5	7	33	0	27	32	14	Three on— 26th December 1920, 4th February 1921 and 7th March 1921.	Ditto	Ditto.
	2	„ 8-A ...	2	5	8	18	0	30	1	12		Ditto	Ditto.
	3	Pb. 11 ...	2	5	8	19	0	30	5	5		Ditto	Ditto.
	4	„ 8-A ...	2	5	7	14	0	26	5	5		Ditto	Ditto.
19 to 2	1	Pb. 11 ...	1	15	3	8	8	14	27	6	Three on— 24th December 1920, 14th January 1921 and 10th March 1921.	28th October 1920	Ditto.
	2	„ 8-A ...	1	15	3	8	0	14	25	2		Ditto	Ditto.
	3	Pb. 11 ...	1	15	4	0	12	18	14	13		Ditto	Ditto
	4	„ 8-A ...	1	15	5	11	8	24	6	13		Ditto	Ditto.
17 to 18	1	Pb. 11 ...	2	2½	6	35	8	26	3	5	Three on— 22nd December 1920, 4th February 1921, and 10th March 1921.	13th October 1920	Ditto.
	2	„ 8-A ...	2	2½	7	0	0	26	20	5		Ditto	Ditto.
	3	Pb. 11 ...	2	2½	7	25	8	28	36	14		Ditto	Ditto.
	4	„ 8-A ...	2	2½	7	26	8	29	0	11		Ditto	Ditto.

			Average outturn per acre								Average outturn per acre calculated on yield per acre.
											Mds. Srs. Chs.
	1	Pb.-11 ...	16	10½	55	13	0	26	31	5	26 11 5
	2	„ 8-A ...	16	10½	53	31	0	26	1	5	25 28 5

Statement No. VIII

SHOWING THE COMPARATIVE VARIETAL RESULT OF EARLY SOWN WHEAT (TYPES 11 AND 8-A) ON GOOD LAND WITH TWO IRRIGATIONS, GROWN IN TENANTS' LAND DURING RABI, 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Number of irrigations with dates.	Date of sowing.	Remarks.
13/16	1	Pb. 11 ...	2	4	4	11	12	15	24	8	Two on— 25th December 1920 and 21st February 1921.	27th October 1920	Germination good, crop good.
	2	„ 8-A ...	2	5	5	13	0	19	14	8		Ditto	Ditto.
	3	Pb. 11 ...	2	4	4	23	8	16	27	4		Ditto	Ditto.
	4	„ 8-A ...	2	4	5	1	0	18	10	14		Ditto	Ditto.
16/13	1	Pb. 11 ...	1	19	3	29	0	15	11	4	Two on— 26th December 1920 and 25th February 1921.	Ditto	Ditto.
	2	„ 8-A ...	1	19	4	14	8	17	35	14		Ditto	Ditto.
	3	Pb. 11 ...	1	19	4	5	0	16	36	1		Ditto	Ditto.
	4	„ 8-A ...	1	19	3	38	8	16	10	4		Ditto	Ditto.
19/11	1	Pb. 11 ...	1	18	4	29	12	19	38	15	Two on— 1st December 1920 and 25th February 1921.	28th October 1920	Germination good, crop fair
	2	„ 8-A ..	1	18	3	38	8	15	25	4		Ditto	Ditto.
	3	Pb. 11 ...	1	18	2	25	8	11	4	3		Ditto	Ditto.
	4	„ 8-A ...	1	18	2	39	0	12	21	0		Ditto	Ditto.
17/24	1	Pb. 11 ...	1	19½	7	30	0	31	15	11	Two on— 24th December 1920 and 5th March 1921.	30th October 1920.	Germination good, crop good
	2	„ 8-A ...	1	19½	7	14	0	29	30	14		Ditto	Ditto.
	3	Pb. 11 ...	1	19½	8	19	0	34	13	2		Ditto	Ditto.
	4	„ 8-A ...	1	19½	7	26	0	30	39	7		Ditto	Ditto.

			Average outturn per acre								Average outturn per acre calculated on yield per acre.		
											Mds.	Srs.	Chs.
	1	Pb. 11 ...	16	1	40	13	8	20	4	3	20	6	6
	2	„ 8-A ...	16	1	40	24	8	20	9	11	20	3	8

M

Statement No. IX

SHOWING THE COMPARATIVE VARIETAL TESTS OF EARLY SOWN WHEAT (TYPES 11 AND 8-A) ON LIGHT LAND WITH THREE IRRIGATIONS GROWN IN TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Number of irrigations with dates.	Date of sowing.	Remarks.
12 2	1	Pb. 11 ...	1	16	3	29	0	16	22	3	Three on— 1st December 1920, 29th January 1921 and 9th March 1921.	28th October 1920	Germination good, crop average.
	2	„ 8-A ...	1	16	2	36	0	12	35	9		Ditto	Ditto.
	3	Pb. 11 ...	1	16	4	3	0	18	4	7		Ditto	Ditto.
	4	„ 8-A ...	1	16	4	3	0	18	4	7		Ditto	Ditto.
7 19	1	Pb. 11 ...	2	2¾	6	21	0	24	16	13	Three on— 1st December 1920, 30th January 1921 and 7th March 1921.	25th October 1920	Germination good, crop good.
	2	„ 8-A ..	2	2¾	5	22	8	20	32	12		Ditto	Ditto.
	3	Pb. 11 ...	2	2¾	5	24	12	21	1	2		Ditto	Ditto.
	4	„ 8-A ...	2	2¾	4	15	0	15	2	5		Ditto	Ditto.
10 3	1	Pb. 11 ...	1	19	3	3	0	12	24	10	Ditto ditto	2nd November 1920	Germination good, crop average.
	2	„ 8-A ...	1	19	4	23	0	18	30	12		Ditto	Ditto.
	3	Pb. 11 ...	1	19	4	3	0	16	28	11		Ditto	Ditto.
	4	„ 8-A ...	1	19	4	30	8	19	21	8		Ditto	Ditto.
		Average outturn per acre.										Average outturn per acre calculated on yield per acre. Mds. Srs. Ch.	
	1	Pb. 11 ...	11	15½	27	3	12	18	16	5		18 19 10	
	2	„ 8-A ...	11	15½	26	10	0	17	33	7		17 21 3	

Statement No. X

SHOWING THE COMPARATIVE VARIETAL RESULTS OF EARLY SOWN WHEAT (TYPES 11 AND 8-A) ON LIGHT LAND WITH TWO IRRIGATIONS, GROWN IN TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Number of irrigations with dates.	Date of sowing.	Remarks.
3 23	1	Pb. 11 ..	1	16¾	2	24	8	11	14	13	Two on— 27th December 1920 and 1st March 1921.	1st November 1920.	Germination good, crop average.
	2	„ 8-A ...	1	16¾	2	22	8	11	6	4		Ditto	Ditto.
	3	Pb. 11 ...	1	16¾	3	15	0	14	27	12		Ditto	Ditto.
	4	„ 8-A ...	1	16¾	4	36	0	21	13	5		Ditto	Germination good, crop good.
7 18	1	Pb. 11 ...	2	3	6	35	8	25	25	2	Two on— 28th December 1920 and 28th February 1921.	2nd November 1920.	Germination good, crop good.
	2	„ 8-A ...	2	3	7	15	0	27	17	10		Ditto	Ditto.
	3	Pb. 11 ...	2	3	5	26	8	21	2	12		Ditto	Ditto.
	4	„ 8-A ...	2	3	7	3	8	26	14	14		Ditto	Ditto.
11 7	1	Pb. 11 ...	1	14	...	36	0	4	9	6	Two on— 26th December 1920 and 9th March 1921.	27th October 1920.	Germination good, crop poor.
	2	„ 8-A ...	1	14	1	26	0	7	30	9		Ditto	Ditto.
	3	Pb. 11 ...	1	14	1	22	0	7	11	12		Ditto	Ditto.
	4	„ 8-A ...	1	14	1	13	8	6	11	12		Ditto	Ditto.
		Average outturn per acre.										Average outturn per acre calculated on yield per acre. Mds. Srs. Ch.	
	1	Pb. 11 ...	11	7½	20	39	8	14	30	6		14 1 15	
	2	„ 8-A	11	7½	24	36	8	17	20	13		16 29 1	

Statement No. XI

SHOWING THE COMPARATIVE VARIETAL RESULTS OF LATE SOWN WHEATS (TYPES 11 AND 8-A) ON GOOD LAND WITH THREE IRRIGATIONS GROWN IN THE TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Number of irrigations with dates.	Date of sowing.	Remarks.
13/11	1	Pb. 11 ...	1	19	3	9	12	13	12	5	Three on— 19th January 1921, 10th February 1921 and 21st March 1921.	22nd November 1920.	Germination good, crop average.
	2	„ 8-A ...	1	19	3	34	0	15	31	12		Ditto	Ditto.
	3	Pb. 11 ...	1	19	3	19	8	14	12	5		Ditto	Ditto.
	4	„ 8-A ...	1	19	3	14	0	13	29	12		Ditto	Ditto.
17/19	1	Pb. 11 ...	2	3	6	10	8	23	12	1	Three on— 18th January 1920, 9th February 1921 and 28th March 1921.	1st December 1920.	Germination good, crop good.
	2	„ 8-A ...	2	3	6	15	8	23	30	11		Ditto	Ditto.
	3	Pb. 11 ...	2	3	6	29	8	25	2	12		Ditto	Ditto.
	4	„ 8-A ...	2	3	6	8	0	23	2	12		Ditto	Ditto.
16/15	1	Pb. 11 ...	1	17½	3	8	0	13	26	2	Three on— 19th January 1921, 11th February 1921 and 20th March 1921.	29th November 1920.	Germination good, crop average.
	2	„ 8-A ...	1	17½	3	29	8	15	37	14		Ditto	Ditto
	3	Pb. 11 ...	1	17½	3	33	8	16	14	15		Ditto	Ditto.
	4	„ 8-A ...	1	17½	3	5	8	13	15	7		Ditto	Ditto.
16/6/2	1	Pb. 11 ...	1	17½	3	3	0	13	4	12		22nd November 1920.	Ditto.
	2	„ 8-A ...	1	17½	2	23	0	10	39	7		Ditto	Ditto.
Average outturn per acre.												Average outturn per acre. Mds. Srs. Chs.	
	1	Pb. 11 ...	13	16½	29	33	12	17	10	12		17 0 12	
	2	„ 8-A ...	13	16½	29	9	8	16	36	12		16 26 13	

Statement No. XII

SHOWING THE COMPARATIVE VARIETAL RESULTS OF LATE SOWN WHEAT (PB. 11 AND 8-A) ON GOOD LAND WITH TWO IRRIGATIONS GROWN IN TENANTS' AREA DURING RABI 1920-21

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Number of irrigations with dates.	Date of sowing.	Remarks.
16	1	Pb. 11 ...	2	1	2	37	0	11	16	9	Two on— 21st January 1921 and 5th March 1921.	29th November 1920.	Germination good, crop fair.
	2	„ 8-A ...	2	1	2	8	8	8	25	6		Ditto	Ditto.
16	3	Pb. 11 ...	2	1	3	23	8	14	0	0		Ditto	Ditto.
	4	„ 8-A ...	2	1	1	36	0	7	16	9		Ditto	Germination good Crop suffered at some places due to lack of irrigation.
20/4	1	Pb. 11 ...	1	18	4	25	12	19	22	1	Two on— 17th January 1921 and 5th March 1921.	30th November 1920.	Germination good, crop good.
	2	„ 8-A ...	1	18	5	9	0	22	0	0		Ditto	Ditto.
	3	Pb. 11 ...	1	18	4	39	8	21	0	0		Ditto	Ditto.
	4	„ 8-A ...	1	18	4	35	4	20	22	1		Ditto	Ditto.
5/19	1	Pb. 11 ...	2	4	4	17	0	16	3	10	Two on— 18th January 1921 and 9th March 1921.	21st November 1920.	Germination good, crop average.
	2	„ 8-A ...	2	4	4	20	12	16	17	4		Ditto	Ditto.
	3	Pb. 11 ...	2	4	4	0	0	14	21	13		Ditto	Ditto.
	4	„ 8-A ...	2	4	4	11	8	15	23	10		Ditto	Ditto.
Average outturn per acre.												Average outturn per acre calculated on yield per acre. Mds. Srs. Chs.	
	1	Pb. 11 ...	12	6	24	22	12	15	39	3		16 4 0	
	2	„ 8-A ...	12	6	23	1	0	14	38	0		15 4 2	

Statement No. XIII

SHOWING THE COMPARATIVE VARIETAL RESULTS OF LATE SOWN WHEAT (TYPES 11 AND 8-A) GROWN IN TENANTS' AREA ON LIGHT LAND WITH THREE IRRIGATIONS DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Number of irrigations with dates.	Date of sowing.	Remarks.
7 / 14	1	Pb. 11 ...	2	1	6	16	0	24	39	0	Three on— 20th January 1921, 16th February 1921 and 21st March 1921.	1st December 1920.	Germination good, crop good.
	2	„ 8-A ...	2	1	5	18	8	21	12	10		Ditto	Ditto.
	3	Pb. 11 ...	2	1	6	13	8	24	29	4		Ditto	Ditto.
	4	„ 8-A ...	2	1	5	30	8	23	19	8		Ditto	Ditto.
7 / 23	1	Pb. 11 ...	2	2	4	23	0	17	17	2	Three on— 18th January. 1921, 16th February 1921 and 21st March 1921.	1st December 1920.	Germination good, crop average.
	2	„ 8-A ...	2	2	4	6	8	15	34	4		Ditto	Ditto.
	3	Pb. 11 ...	2	2	4	8	0	16	0	0		Ditto	Ditto.
	4	„ 8-A ...	2	2	3	17	0	13	1	14		Ditto	Ditto.
11 / 8	1	Pb. 11 ...	1	18	2	30	8	11	25	4	Three on— 14th January 1921, 12th February 1921 and 21st March 1921.	21st November 1920.	Germination good, crop rather poor.
	2	„ 8-A ...	1	18	1	17	8	6	2	2		Ditto	Ditto.
	3	Pb. 11 ...	1	18	2	6	8	9	4	3		Ditto	Ditto.
	4	„ 8-A ...	1	18	2	10	8	9	21	1		Ditto	Ditto.
	1	Pb. 11 ...	12	2	28	17	8	17	19	2			
	2	„ 8-A ...	12	2	22	20	8	14	35	6			

Average outturn per acre.

Average outturn per acre calculated on yield per acre.

	Mds.	Srs.	Chs.
1	17	12	7
2	14	28	9

Statement No. XIV

SHOWING THE COMPARATIVE VARIETAL RESULTS OF LATE SOWN WHEAT (TYPES 11 AND 8-A) ON LIGHT LAND WITH TWO IRRIGATIONS GROWN IN TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Number of irrigations with dates.	Date of sowing.	Remarks.
7 / 13	1	Pb. 11 ...	2	1¼	6	38	8	27	0	4	Two on— 20th January 1921 and 7th March 1921.	30th November 1920.	Germination good, crop good.
	2	„ 8-A ...	2	1¼	5	21	8	21	19	2		Ditto	Ditto.
	3	Pb. 11 ...	2	1¼	6	19	8	25	6	9		Ditto	Ditto.
	4	„ 8-A ...	2	1¼	6	23	0	25	20	2		Ditto	Ditto.
7 / 22	1	Pb. 11 ...	2	1½	2	36	6	11	8	11	Two on— 13th January 1921 and 7th March 1921.	1st December 1920.	Germination good, crop rather poor.
	2	„ 8-A ...	2	1½	2	26	4	10	9	10		Ditto	Ditto.
	3	Pb. 11 ...	2	1½	2	38	8	11	16	14		Ditto	Ditto.
	4	„ 8-A ...	2	1½	2	14	4	9	3	6		Ditto	Ditto.
8 / 9+12	1	Pb. 11 ...	2	3½	3	25	8	13	15	3	Two on— 15th January 1921 and 8th March 1921.	26th November 1920.	Germination good, crop fair.
	2	„ 8-A ...	2	3½	3	10	0	11	38	2		Ditto	Ditto.
	3	Pb. 11 ..	2	3	2	25	8	9	32	9		Ditto	Ditto.
	4	„ 8-A	2	3	2	38	8	11	0	14		Ditto	Ditto.
	1	Pb. 11 ...	12	12	25	23	14	16	10	1			
	2	„ 8-A ...	12	12	23	13	8	14	32	11			

Average outturn per acre.

Average outturn per acre calculated on yield per acre.

	Mds.	Srs.	Chs.
1	16	13	5
2	14	35	3

Statement No XV.

COMPARATIVE VARIETAL TESTS OF WHEATS (TYPES 17 AND 8-A) GROWN IN TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Number of irrigations with dates.	Date of sowing.	Remarks.
17/23	1	Pb. 17	2	1	6	4	8	23	34	2	Three on— 22nd December 1920, 28th January 1921 and 28th February 1921.	14th November 1920.	Germination good, crop good.
	2	„ 8-A ...	2	1	5	39	0	23	12	11		Ditto	Ditto.
	3	Pb. 17	2	1	6	11	0	24	19	8		Ditto	Ditto.
	4	„ 8-A	2	1	6	25	8	25	36	1		Ditto	Ditto.
12/3	1	Pb 17 ...	1	17½	3	4	0	13	9	1	Four on — 26th December 1920, 30th January 1921, 21st February 1921 and 9th March 1921.	9th November 1920.	Germination good, crop average.
	2	„ 8-A	1	17½	3	20	8	14	38	7		Ditto	Ditto.
	3	Pb. 17 ...	1	17½	3	22	0	15	5	13		Ditto	Ditto.
	4	„ 8-A ...	1	17½	3	20	0	14	37	5		Ditto	Ditto.
12/4	1	Pb. 17 ...	1	19	2	30	8	11	13	5	Four on— 26th December 1920, 30th January 1921, 21st February 1921 and 9th March 1921.	9th November 1920.	Germination good, crop average.
	2	„ 8-A ...	1	19	2	35	0	11	31	12		Ditto	Ditto.
	3	Pb. 17 ...	1	19	3	5	8	12	34	14		Ditto	Ditto.
	4	„ 8-A ...	1	19	3	18	12	14	9	3		Ditto	Ditto.
5/22/2	1	Pb 17 ...	2	3	5	18	4	20	12	1	Four on — 1st December 1920, 18th January 1921, 12th February 1921 and 9th March 1921.	28th October 1920.	Germination good, crop good.
	2	„ 8-A ...	2	3	5	10	0	19	21	6		Ditto	Ditto.

Average outturn per acre.

											Average outturn per acre calculated on yield per acre. Mds.	Srs.	Chs.
1	Pb. 17 ...	13	18	30	15	12	17	19	11		17	12	11
2	„ 8-A ...	13	18	31	8	12	17	38	11		17	32	8

Statement No. XVI

SHOWING THE COMPARATIVE VARIETAL RESULTS OF WHEATS (TYPES 11 AND N. $H_4 \times P_6$) GROWN IN TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Number of irrigations with dates.	Date of sowing.	Remarks.
3/4	1	Pb. 11 ...	1	19	7	31	0	31	35	14	Four on— 22nd December 1920, 24th January 1921, 17th February 1921 and 26th March 1921.	1st November 1920.	Germination and crop good.
	2	N. $H_4 \times P_6$	1	19	5	23	8	22	36	14		Ditto	Ditto.
	3	Pb. 11 ...	1	19	8	23	4	35	8	3		Ditto	Ditto.
	4	N. $H_4 \times P_6$	1	19	5	38	0	24	16	6		Ditto	Ditto.

Average outturn per acre.

											Average outturn per acre calculatrd on yield per acre. Mds.	Srs.	Chs.
1	Pb. 11 ...	3	18	16	14	4	33	22	0		33	22	0
2	N. $H_4 \times P_6$	3	18	11	21	8	23	26	10		23	26	10

Statement No. XVII.

RESULTS OF HYDRAULIC EXPERIMENTS WITH WHEAT TYPE XI GROWN IN SQUARE 10, RABI 1920-21 (EARLY SOWN. TWO *VERSUS* THREE IRRIGATIONS).

No. of square and plot.	No. of sub-plot.	Treatment.	Area.		Actual outturn.				Outturn per acre.				Irrigation in inches with dates.					Total irrigations in inches including rauni.	Rainfall during the growing period of wheat.	Total amount in inches including rain.	Remarks.
					Grain.		*Straw.*		*Grain.*		*Straw.*		*For rauni.*	*After sowing.*							
														1st	2nd	3rd					
			Kanals.	Marlas.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	16th November 1920.	20th December 1921.	15th February 1921.	23rd March 1921.	Total.				
10 $C_1 b$	1	Three irrigations	2	0	6	2⅜	9	21¼	24	11	38	5	3·09	2·77	2·87	2·87	8·51	11·60	·16	11·76	Plots with two irrigations lodged to some extent at the last watering (on 23rd March 1921).
	2	Two irrigations	2	0	4	27½	7	11½	18	30	29	6	3·09	2·77	...	2·87	5·64	8·73	·16	8·89	
	3	Three irrigations	2	0	5	31	9	24½	23	4	38	18	3·09	2·77	2·87	2·87	8·51	11·60	·16	11·76	
	4	Two irrigations	2	0	4	17	7	19	17	28	29	36	3·09	2·77	...	3·48	6·25	9·34	·16	9·50	
10 $C_2 b$	1	Two irrigations	2	0	5	26½	9	14½	22	26	37	18	3·09	2·77	...	2·87	5·64	8·73	·16	8·89	
	2	Three irrigations	2	0	6	2¼	9	38¾	24	9	39	35	3·09	2·77	2·87	2·87	8·51	11·60	0 16	11·76	
	3	Two irrigations	2	0	5	18¾	9	17⅛	23	35	37	29	3·09	2·77	...	2·87	5·64	8·73	·16	8·89	
	4	Three irrigations	2	0	4	36½	8	20½	19	26	34	2	3·09	2·77	2·87	3·09	8·73	11·82	·16	11·98	

AVERAGE YIELD OF GRAIN PER ACRE.

	Mds.	Srs.	Chs.
Three waterings	22	32	8
Two waterings	20	9	12

Statement No. XVIII.

RESULT OF HYDRAULIC EXPERIMENTS WITH LATE SOWN WHEAT TYPE XI, GROWN IN SQUARE 10, RABI 1920-21 (TWO *VERSUS* THREE IRRIGATIONS).

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn, Grain. Maunds.	Actual outturn, Grain. Seers.	Actual outturn, Straw. Maunds.	Actual outturn, Straw. Seers.	Outturn per acre. Grain. Maunds.	Outturn per acre. Grain. Seers.	Outturn per acre. Straw. Maunds.	Outturn per acre. Straw. Seers.	Irrigation in inches with dates. for Rauni 9th November 1920.	After sowing 1st 17th January 1921.	After sowing 2nd 5th March 1921.	After sowing 3rd 30th March 1921.	Total inches.	Total irrigation in inches including rauni.	Rain fall after sowing till repening.	Total amount of water in inches including rain.	Remarks.
10 B 1 B	1	Three irrigations	2	0	4	4½	7	34½	16	18	31	18	3·09	2·66	2·65	2·56	7·87	0·96	·16	11-12	Grain much shrevelled in case of two irrigations. Plots with two irrigations lodged to some extent at the last watering.
	2	Two irrigations	2	0	2	32½	7	30½	11	11	31½	1	3·09	2·66	...	3·09	5·75	8·84	·16	9·00	
	3	Three irrigations	2	0	4	19½	8	13½	17	39	33	13	3·09	2·66	2·65	2·77	8·08	11·17	·16	11·33	
	4	Two irrigation	2	0	2	29	7	11	10	36	29	4	3·09	2·66	...	3·18	5·84	8·93	·16	9·09	
10 B 2 B	1	Three irrigations	2	0	3	28½	8	10½	14	33	33	13	3·09	2·66	...	3·18	5·84	8·93	·16	9·09	
	2	Two irrigations	2	0	5	33½	8	8½	23	13	32	3	3·09	2·66	2·65	2·66	7·97	11·06	·16	11·22	
	3	Three irrigations	2	0	3	23½	7	24½	14	13	30	19	3·09	2·66	...	3·55	6·19	9·28	·16	9·44	
	4	Two irrigations	2	0	5	4½	7	29½	20	19	30	37	3·09	2·66	2·65	2·66	7·97	11·06	·16	11·22	

Ploughings	4
Harrowings	5
Sohagaings	2
Sowings	24th November 1920.
Bar harrowings	2
Harvesting	26th and 27th Aprit 1921.

Average yield per area of grain.

	Mds.	Srs.	Chs.
Three irrigations	19	22	4
Two irrigations	12	33	4

Statement No. XIX

SHOWING THE RESULTS OF HOT WEATHER CULTIVATION *VERSUS* RAIN PLOUGHING IN TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	Type of wheat.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chhitaks.	Actual outturn of Bhusa. Maunds.	Actual outturn of Bhusa. Seers.	Actual outturn of Bhusa. Chhitaks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chhitaks.	Outturn of Bhusa per acre. Maunds.	Outturn of Bhusa per acre. Seers.	Outturn of Bhusa per acre. Chhitaks.	Date of sowing.	Date of irrigation, with dates.	Remarks.
							(*a*) Hot weather Ploughing.											
6/8	Punjab 11...	8	12	8	7	0	15	7	0	7	24	3	14	4	10	16th November 1920.	Four on—	
6/10	Do.	7	11	9	27	8	17	39	8	10	10	9	19	2	6	Ditto	13th January 1921, 4th February 1921, 28th February 1921, and 20th March 1921.	Germination good, crop poor, patches of kallar.
6/12	Do.	8	7	9	25	8	15	24	8	9	9	5	14	38	5	Ditto		
6/14	Do.	8	11	11	19	8	18	28	8	10	29	15	17	20	5	17th November 1920.		
							(*b*) Rain Ploughing.											
6/7	Punjab 11...	9	2	18	25	0	28	31	0	16	14	15	25	11	13	17th November 1920.	Four on—	Germination and crop good.
6/9	Do.	8	17	10	6	8	17	38	8	9	7	7	16	9	8	Ditto	13th January 1921, 4th February 1921, 28th February 1921, and 20th March 1921.	Germination and crop fairly satisfactory, but Kallar patches here and there.
6/11	Do.	7	2	11	3	8	16	28	8	12	19	11	18	33	3	16th November 1920.		
6/13	Do.	8	1	15	2	0	28	28	0	14	38	3	23	20	14	Ditto		
							Average yield per acre.											
1	Hot weather cultivation.	33	1	3	39	8	67	19	8	9	17	7	16	13	6			
2	Rain ploughing.	33	2	54	37	0	92	6	0	13	10	15	22	10	14			

Average yield per acre calculated on outturn per acre.

	Grain. Mds.	Srs.	Chs.	*Bhusa.* Mds.	Srs.	Chs.
Hot weather cultivation	9	18	8	16	16	6
Rain ploughing	13	10	1	21	8	13

Statement No. XX

SHOWING THE RESULTS OF HARROWING WHEAT WITH BAR HARROW IN SQUARE 27/C2.

No. of square.	No. of plot.	Areas in acres.	Treatment.	Actual yield. *Grain.* Maunds.	Seers.	Chhitaks.	*Straw.* Maunds.	Seers.	Chhitaks.	Yield per acre. *Grain.* Maunds.	Seers.	Chhitaks.	*Straw.* Maunds.	Seers.	Chhitaks.	Date of sowing.	Irrigation with dates.	Previous crops.	Remarks.
27-C2.	1	¼	Control ...	8	35	0	19	25	0	35	20	0	78	20	0	30th October 1920.	Three on— 19th December 1920. 16th February 1921. 17th March 1921.	Sugar cane.	Ploughings—Raja Plough ... 1; Desi plough ... 4; Harrowings ... 7; Sohagaings ... 6; Bar harrowings 1 to plots 2, 4, 6 and 8.
,,	2	¼	Harrowed	9	3	4	22	23	12	36	13	0	90	15	0	Ditto		Do.	
,,	3	¼	Control ...	10	12	4	21	13	12	41	9	0	85	15	0	Ditto		Do.	
,,	4	¼	Harrowed	9	7	10	23	26	6	36	30	8	94	25	8	Ditto		Do.	
,,	5	¼	Control ...	10	14	4	23	12	12	41	17	0	93	11	9	Ditto		Do.	
,,	6	¼	Harrowed	9	7	8	17	34	8	36	30	0	71	18	0	Ditto		Do.	
,,	7	¼	Control ...	9	31	2	19	7	14	39	4	8	77	31	8	Ditto		Do.	
,,	8	¼	Harrowed	9	39	0	22	25	0	39	36	0	90	20	0	Ditto		Do.	

Average yield per acre.

	Harrowed. Mds.	Srs.	Chs.	*Unharrowed control.* Mds.	Srs.	Chs.
Actuals ...	37	17	6	39	12	10

Statement No. 21.

RESULTS OF NITRATE OF SODA ON WHEAT TYPE XI GROWN IN SQUARE 7, RABI 1920-21.

Nitrate of soda at 1 cwt. and 1½ cwt. *versus* unmanured.

No. of Square and Killa.	No. of plot.	Application of nitrate of soda.	MANURED. Outturn per acre. Grain. Maunds.	Grain. Seers	Bhusa. Maunds.	Bhusa. Seers.	No. of Square and Killa.	No. of plot.	UNMANURED. Outturn per acre. Grain. Maunds.	Grain. Seers.	Straw. Maunds.	Straw. Seers.	Increase per acre. Grain. Maunds.	Grain. Seers.	Straw. Maunds.	Straw. Seers.	Increased (+) or decreased (−) value of grain at Rs. 6-1-0 per maund and that of Bhusa at Rs. 2 per maund.	Expenditure of Nitrate of Soda at Rs. 25 per cwt.	Loss per acre.	Remarks.
		Cwt.															Rs. A. P.	Rs. A. P.	Loss. Rs. A. P.	
7/8	2	1½	8	8	15	30	7/8	1	5	31	8	1	2	17	7	29	+ Grain ... = 14 11 3 + Bhusa ... = 15 7 2 Total ... 30 2 5	37 8 0	7 5 7	It was a rainless and dry year. These plots seem to be unsuitable for this experiment as they contain already a good amount of salt as apparent by the presence of Kallar patches.
		Cwt.																	Loss. Rs A. F.	
7/9	1	1	7	24	15	29	7/9	2	7	25	13	20	Decrease by 1 seer.		2	9	− Grain ... = 0 2 5 + Bhusa ... = 4 7 2 Total ... 4 4 9	25 0 0	20 11 3	

Ploughings 5

Sohagaings ... ... 3 and one sohaga after sowing.

Harrowings { Horse hoe ... ... 6; Bar harrow 1

Sowing ... ... 5th November 1920.

Bar harrow 3

Date of application of Nitrate of Soda 26th December 1920.

Waterings 3 on 26th December 1920, 15th February 1921 and 17th March 1921.

Harvesting on 27th and 28th April 1921.

Statement No. 22

SHOWING THE RESULTS OF EARLY AND LATE GREEN MANURING OF WHEAT IN SQUARE 26-B, RABI 1920-21.

No. of square.	No. of plot.	Area in acres.	Treatment.	Actual Yield.						Yield per acre.						Date of sowing.	Number of irrigations with dates.	Irrigation in inches.
				Grain.			Straw.			Grain.			Straw.					
				Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
26-B	1	1 7	Green manured with early guara ...	1	18	0	3	18	0	10	6	0	24	6	0	4th November 1920 ...	3 on— 21st December 1920. 14th February 1921. 17th March 1921.	10·75
	2		Control ...	2	17	2	5	28	6	16	39	14	39	38	10			
	3		Green manured with late guara ..	2	4	8	4	12	0	14	31	8	30	4	0			
	4		Green manured with early guara ...	2	19	9	5	17	0	17	16	15	37	39	0			
	5		Control ...	2	23	4	5	29	12	18	2	12	40	8	4			
	6		Green manured with late guara ...	2	15	4	4	8	4	16	26	12	29	17	12			
	7		Green manured with early guara ...	2	27	4	5	24	12	18	30	12	39	13	4			
	8		Control ...	2	14	12	5	21	4	16	23	4	38	28	12			
	9		Green manured with late guara ...	2	7	14	5	17	2	15	15	2	37	39	14			
	10		Green manured with early guara ..	2	34	14	4	35	10	20	4	2	34	9	6			
	11		Control ...	3	13	8	6	0	8	23	14	8	42	3	8			
	12		Green manured with late guara ...	3	34	12	5	5	12	20	3	4	36	0	4			

Average yield per acre in case of green manured with early guara ... ... = Mds. 16 Srs. 24 Ch. 7
" " " " " " with late guara ... ... = 16 29 2
" " " " " " with control ... ... = 18 30 2

NOTE.—Control plots ripened a bit earlier than the green manured plots, in the latter case some grains did not develop properly on account of the severe hot dry weather and the ears withered prematurely.

Ploughings—Rajah plough 1.
Desi plough 1.
Sohagaings 5
Harrowings 2
Bar harrowings 3

Statement No. 23.

RESULTS OF GREEN MANURING OF GUARA ON WHEAT IN AREA C, SQUARE 2, RABI 1920-21.

No. of square and block.	No. of plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Grain. Maunds.	Actual outturn. Grain. Seers.	Actual outturn. Straw. Maunds.	Actual outturn. Straw. Seers.	Outturn per acre. Grain. Maunds.	Outturn per acre. Grain. Seers.	Outturn per acre. Straw. Maunds.	Outturn per acre. Straw. Seers.	Number and dates of irrigations.	Remarks.
2 C	1	Guara ploughed in on 8th October 1920.	7	1 8—2	8	7 38—8	15	1 25—2	9	26	16	34	Four on— 26th December 1920, 14th February 1921, 5th March 1921 and 31st March 1921.	Owing to the dry year guara made very poor growth.
	2	Fallow ...	7	9 3—10	5	1 38—2	9	33	6	25	10	37		
	3	Guara ploughed in on 8th October 1920.	7	9	6	3 7—16	8	1 25—2	6	25	9	11		
	4	Fallow ...	7	4 5—15	4	1 31—8	7	3 30—8	5	10	8	22		

	Plots 2 and 4 (fallow.)	*Plots 1 and 3 before ploughing guara.*	*After ploughing guara.*
Ploughings ...	—4	1	1
Harrowings—Horse Hoe ...	5	1	1
Sohagaings ...	2	*Nil*	2

Sowing done on—6th November 1920 :— 3

Waterings 4—on 26th December 1920, 14th February 1921, 5th March 1921, and 31st March 1921.

Harvesting on 18th April 1921.

AVERAGE YIELD PER ACRE OF GRAIN.

	Mds.	Srs.	Ch.
Guara ploughed in ...	8	5	15
Fallow	5	37	11

Statement No. 24.

GREEN MANURING WITH GUARA AGAINST FALLOW ON WHEAT PB. 11 ON TENANTS' AREA, RAPI 1920-21.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chataks.	Actual outturn of bhusa. Maunds.	Actual outturn of bhusa. Seers.	Actual outturn of bhusa. Chataks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chataks.	Outturn of bhusa per acre. Maunds.	Outturn of bhusa per acre. Seers.	Outturn of bhusa per acre. Chataks.	Date of sowing.	Number of irrigations with dates.	Remarks.
7 — 12	1	Fallow ...	2	1	4	24	0	7	30	0	17	38	0	30	9	12	12th November 1920	Four on— 21st December 1920, 23rd January 1921. 28th February 1921. 28th March 1921.	Germination and crop good.
	2	Green manuring with guara.	2	1	5	23	0	10	31	0	21	30	4	42	5	13	Ditto ...		
	3	Fallow ...	2	1	3	37	0	8	15	0	15	12	11	32	27	5	Ditto ...		Do.
	4	Green manuring with guara.	2	1	6	4	8	12	34	8	23	34	2	50	7	12	Ditto ...		Do.
		Average yield per acre.																	
	1	Fallow ...	4	2	8	21	0	16	5	0	16	25	5	31	18	8			
	2	Green manuring with guara.	4	2	11	27	8	23	26	8	22	32	3	46	6	12			

AVERAGE YIELD PER ACRE.

	Grain. Mds.	Srs.	Ch.	*Bhusa.* Mds.	Srs.	Ch.
Fallow ...	16	25	5	31	18	8
Green manured ...	22	32	3	46	6	12

Statement No. 25

SHOWING THE RESULTS OF GREEN MANURING FOR WHEAT TYPE PB. 11 IN TENANTS' AREA DURING RABI 1920-21.

No. of square, plot, and sub-plot.	Treatment.	Area.		Actual outturn of grain.			Actual outturn of bhusa.			Outturn of grain per acre.			Outturn of bhusa per acre.			Number of square plot and sub-plot.	Treatment.	Area.		Actual outturn of grain.			Actual outturn of bhusa.			Outturn of grain per acre.			Outturn of bhusa per acre.			Date of sowing.	Number of irrigations with dates.	Remarks.
		Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.			
13/19 — 1	San ploughed in on 8th September 1920.	4	10	9	24	0	26	13	0	17	2	10	46	32	0	13/19 — 2	Guara ploughed in on 7th September 1920.	4	10	7	35	0	17	21	0	14	0	0	31	6	3	10th November 1920.	Four on — 28th December 1920, 27th January 1921, 20th February 1921 and 27th March 1921.	Germination good. Crop average.
13/20 — 1	San ploughed in on 7th September 1920.	4	6½	8	26	0	17	36	0	16	0	0	33	4	6	13/20 — 2	Guara removed on 8th September 1920.	4	6½	7	5	8	13	22	8	13	8	1	25	3	7	11th November 1920.		
13/21 — 1	San ploughed in on 8th September 1920.	4	3½	7	28	0	13	0	0	14	30	3	24	36	6	13/21 — 2	Guara ploughed in on 7th September 1920.	4	3½	7	1	0	12	0	0	13	18	7	22	39	12	Ditto ..		
13/22 — 1	San ploughed in on 7th September 1920.	4	6½	7	30	8	13	19	8	14	14	5	24	37	14	13/22 — 2	Guara removed on 7th September 1920.	4	6½	6	35	8	11	0	8	12	29	9	20	14	12	10th November 1920.		
	AVERAGE YIELD PER ACRE.																																	
1	San ploughed in (plots 19 and 21).	8	13½	17	12	0	39	13	0	15	38	2	36	10	9																			
2	Guara ploughed in (plots 19 and 21).	8	13½	14	36	0	29	21	0	13	29	10	27	9	1																			
3	San ploughed in (plots 20 and 22).	8	13	16	16	8	31	15	8	15	7	2	29	1	2																			
4	Guara removed from plots (20 22).	8	13	14	1	0	24	23	0	12	38	13	22	29	2																			

AVERAGE OUTTURN PER ACRE CALCULATED ON YIELD PER ACRE.

	Grain.			Bhusa.		
	Mds.	Srs.	Ch.	Mds.	Srs.	Ch.
1	15	36	6	35	34	3
2	13	29	3	27	2	15
3	15	7	2	29	1	2
4	12	38	13	22	29	2

Statement No. 26

SHOWING THE EFFECT OF LIMING WHEAT PUNJAB-11 AGAINST NO MANURE IN TENANTS' AREA, RABI 1920-21.

No. of square plot and sub-plot.	Area of each sub-plot in acres.	Application of Lime per acre.	MANURED. Actual outturn. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	No. of square and plot and sub-plot.	Area. No. of each sub-plot in acres.	UNMANURED. Actual outturn. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Increase (+) or decrease (−) per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Increased (+) or decreased (−) value of grain at Rs. 6-8-0 per maund, and that of Bhusa at Rs. 2 per maund.	Expenditure on Lime at Re. 1-9-0 per maund.	Gain or loss per acre.	Amount.	Remarks.
		Mds.																																				
16/20 1	1/5	14	6	23	8	14	36	8	32	37	8	72	22	8	16/20 2	1/5	6	11	8	13	35	8	31	17	8	69	37	8	...	...	...	...	...	...	...	...	...	...	Germination good, crop very good.
16/20 3		7	6	20	0	13	11	0	32	20	0	66	15	0	16/20 4		6	27	0	13	32	0	33	15	0	69	0	0	...	...	...	...	...	...	...	...	...	...	Ditto.
16/11 1		14	3	9	8	6	26	8	16	7	8	33	12	8	16/11 2		2	21	0	5	26	8	12	25	0	28	12	8	...	...	...	...	...	...	...	...	...	...	Germination good, crop average.
16/11 3		7	2	32	8	5	5	8	14	2	8	25	27	8	16/11 4		2	31	12	5	14	4	13	38	12	26	31	4	...	...	...	...	...	...	...	...	...	...	Ditto.
16/10 1		14	3	17	0	7	31	0	17	5	0	38	35	0	16/19 2		3	30	0	7	36	0	18	30	0	39	20	0	...	...	...	...	...	...	...	...	...	...	Germination good, crop good.
16/20 3		7	4	0	0	8	18	0	20	0	0	42	10	0	16/10 4		3	36	4	7	23	12	19	21	4	37	38	12	...	...	...	...	...	...	...	...	...	...	Ditto.
			Average yield per acre.														Average outturn per acre calculated on yield per acre.																							
1. Lime 3/5		14	13	10	0	29	14	0	22	3	5	48	36	10			22	3	5	..	...	...	48	36	10	...	...	...	(+) 0	18	12	(+) 3	30	0	Rs. A. P. 10 7 9	Rs. A. P. 21 14 0	Loss ...	Rs. A. P. 11 6 3	
2. Lime 3/5		7	13	12	8	26	34	8	22	7	8	44	30	13			22	7	8	...	...	...	44	30	13	...	...	...	(+) 0	22	15	(−) 0	15	13	2 13 9	10 15 0	Do. ...	8 1 3	
3. No manure 6/5 acres.		Nil	25	37	8	54	8	0	21	24	9	45	6	10			21	24	9	...	...	...	45	6	10	...	...	...	...	...	...	...	...	...	...	...	...	...	

Date of sowing—10th November 1920.

Irrigations four on 27th December 1920, 31st January 1921, 21st February 1921 and 7th March 1921.

Statement No. 27

SHOWING THE RESULTS OF EXPERIMENTS WITH WHEAT (9a 11) SOWN AFTER MAIZE WHICH WAS MANURED IN SQUARE 27 DURING THE RABI OF 1920-21.

No. of square.	No. of plot.	Area in acres.	Treatment (manurial residue from Maize).	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Straw. Maunds.	Seers.	Chataks.	Yield per acre. Grain. Maunds.	Seers.	Chataks.	Straw. Maunds.	Seers.	Chataks.	Date of sowing.	Number of irrigations with dates.	Previous kharif crop.	Remarks.
27 F 1	1	1/10	F. Y. manure at 5 tons per acre.	2	28	8	4	18	0	27	5	0	44	20	0	10th November 1920	Three on – 19th December 1920. 5th February 1921. 16th March 1921.	Maize	Ploughings 2 (1 with Raja, Sohagaings 1 with desi Harrowing 1 plough). Bar Harrowing 1
	2	1/10	Sodium nitrate at 310 lbs. per acre.	2	13	10	4	17	8	23	16	4	44	15	0	Ditto	Ditto	Do.	
	3	1/10	Control	1	4	8	1	32	8	11	5	0	18	5	0	Ditto	Ditto	Do.	
	4	1/10	Bone meal at 300 lbs. per acre.	0	38	8	1	11	12	9	25	0	12	37	8	Ditto	Ditto	Do.	
	5	1/10	Potassium sulphate at 90 lbs. per acre.	0	36	8	1	18	8	9	5	0	14	25	0	Ditto	Ditto	Do.	
	6	1/10	Control	0	34	4	1	13	4	8	22	8	13	12	8	Ditto	Ditto	Do.	
	7	1/10	Sodium nitrate at 310 lbs. per acre. Bone meal at 300 lbs per acre. Potassium sulphate at 90 lbs. per acre.	2	1	4	3	1	4	20	12	8	30	12	8	Ditto	Ditto	Do.	
	8	1/10	Control	0	31	0	1	10	8	7	30	0	12	25	0	Ditto	Ditto	Do.	
	9	1/10	F. Y. manure at 5 tons per acre.	1	0	8	1	32	0	10	5	0	18	0	0	Ditto	Ditto	Do.	
	10	1/10	Sodium nitrate at 310 lbs. per acre.	1	34	8	2	30	8	18	2	0	27	25	2	Ditto	Ditto	Do.	
	11	1/10	Control	0	28	0	0	29	8	7	0	0	7	15	0	Ditto	Ditto	Do.	
	12	1/10	Bone meal at 300 lbs. per acre	0	25	8	1	0	0	6	15	0	10	0	0	Ditto	Ditto	Do.	
	13	1/10	Potassium sulphate at 90 lbs. per acre.	0	37	0	2	7	8	9	10	0	21	35	0	Ditto	Ditto	Do.	
	14	1/10	Control	0	27	8	0	36	8	6	35	0	9	5	0	Ditto	Ditto	Do.	
	15	1/10	Sodium nitrate at 310 lbs. per acre. Bone meal at 300 lbs. per acre Potassium sulphate at 90 lbs. per acre.	1	20	0	2	19	0	15	0	0	24	30	0	Ditto	Ditto	Do.	
	16	1/10	Control	0	24	8	0	35	8	6	5	0	8	35	0	Ditto	Ditto	Do.	

	Mds.	Srs.	Ch.
Average yield per acre with F. Y. M.	18	25	0
" " " " " Sodium Nitrate	21	0	10
" " " " " Bone Meal	8	0	0
" " " " " Potassium Sulphate	9	7	8
" " " " " Control	7	36	4
" " " " " Complete manure	17	26	4

Statement No. 28

SHOWING THE OUTTURN OF WHEAT IN ROTATIONAL SERIES OF EXPERIMENTS IN SQUARE 26-A, RABI 1920-21.

No. of square, block and plot.	No. of sub-plot.	Area in acres.	Treatment.	Actual yield. *Grain.* Maunds.	Seers.	Chataks.	*Straw.* Maunds.	Seers.	Chataks.	Yield per acre. *Grain.* Maunds.	Seers.	Chataks.	*Straw.* Maunds.	Seers.	Chataks.	Date of sowing.	Number of irrigations with dates.	Irrigation in inches.	Remarks.
26 A-I 3	*a*	½	No manure	7	15	10	14	15	0	14	31	4	28	30	0	29th October 1920 ...	Three on— 20th December 1920. 15th February 1921. 17th March 1921.	9·63	Raja plough 1. Desi plough 3. Harrowings 10.
	b	½	Do.	7	0	4	13	11	0	14	0	8	26	22	0	Ditto	Ditto	9·63	Bar Harrowings 4.
26 A-II 3	*a*	½	Do.	6	39	0	12	3	0	13	38	0	24	6	0	Ditto	Ditto	9·63	Raja plough 1, Desi plough 2 } Ploughings. Harrowings 11. Sohagaings 5.
	b	½	Do.	6	38	8	11	17	8	13	37	0	22	35	0	Ditto	Ditto	9·63	Bar Harrowings 4.
26 A-III 3	*a*	½	Green manured with guara--early	13	3	0	20	36	8	26	6	0	41	33	0	Ditto	Ditto	9·63	Raja plough 1. Desi plough 2. Sohagaings 4. Harrowings 2.
	b	½	Ditto	11	4	2	20	27	0	22	8	4	41	14	0	Ditto	Ditto	9·63	Bar Harrowings 4.
26 A-V 3	*a*	½	No manure	5	8	12	11	5	0	10	17	8	22	10	0	Ditto	Three on— 20th December 1920 5th February 1921. 17th March 1921.	9·33	Raja plough 1. Desi plough 3. Harrowings 9. Sohagaings 5.
	b	½	Do.	10	16	0	19	27	0	20	32	0	39	14	0	Ditto	Ditto	9·33	Bar Harrowings 4.

	Mds.	Srs.	Ch.
Average yield per acre without any manure (from 3 fields)	14	26	1
Average yield with green manure (one field only)	24	7	2

Statement No. 29

SHOWING THE COMPARATIVE RESULTS OF 4-F. AND 285-F. COTTONS WITH FREQUENT NUMBER OF WATERINGS GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Number of irrigations with dates.	Previous crop.	Remarks.
19/10	1	4-F. ...	2	3	Heavy loam	2	28	14	10	5	2	Eight on— 13th April 1920. 22nd May 1920. 11th June 1920. 13th June 1920. 16th June 1920. 26th June 1920. 3rd July 1920. 20th July 1920.	Eight on— 7th June 1920. 30th June 1920. 18th July 1920. 31st July 1920. 24th August 1920 7th September 1920. 28th September 1920. 11th October 1920	Senji	Germination and stand good.
	2	285-F. ...	2	3	Ditto	2	10	6	8	16	4			Do.	Ditto.
	3	4-F.	2	3	Ditto	2	17	8	9	2	12			Do.	Ditto.
	4	285-F. ..	2	3	Ditto	1	27	14	6	12	9			Do.	Ditto.
5/11	1	4-F. ...	2	3½	Heavy loam	2	35	6	10	24	6	Six on— 17th April 1920. 11th June 1920. 14th June 1920. 26th June 1920. 5th July 1920. 20th July 1920.	Nine on— 8th June 1920. 20th June 1920. 2nd July 1920. 17th July 1920. 30th July 1920. 28th August 1920. 11th September 1920. 27th September 1920. 6th October 1920.	Senji	Germination good, stand good.
	2	285-F. ...	2	3½	Ditto	2	5	6	7	34	0			Do.	Ditto.
	3	4-F. ...	2	3½	Ditto	2	4	12	7	31	11			Do.	Ditto.
	4	285-F. ...	2	3½	Ditto	1	33	8	7	1	6			Do.	Ditto.
6/6	1	4-F. ...	1	19½	Heavy loam	3	6	2	12	34	2	Five on— 18th April 1920. 16th June 1920. 28th June 1920. 13th July 1920. 29th July 1920.	Eight on— 25th June 1920. 10th July 1920. 23rd July 1920. 19th August 1920. 1st September1920 13th September 1920 30th September 1920. 10th October 1920	Senji	Germination good, crop and stand good.
	2	285-F. ...	1	19½	Ditto	2	24	12	10	27	0			Do.	Ditto.
	3	4-F. ...	1	19½	Ditto	3	18	8	14	4	9			Do.	Ditto.
	4	285-F. ...	1	19½	Ditto	2	26	6	10	33	10			Do.	Ditto.
7/15	1	4-F. ...	1	19½	Medium loam	1	11	14	5	10	2	Six on— 17th April 1920. 25th May 1920. 15th June 1920. 28th June 1920. 13th July 1920. 30th July 1920.	Eight on— 25th June 1920. 10th July 1920. 23rd July 1920. 19th August 1920. 1st September1920 13th September 1920. 1st October 1920. 11th October 1920.	Senji	Germination good.
	2	285-F. ...	1	19½	Ditto	2	17	10	9	35	7			Do.	Ditto.
	3	4-F. ...	1	19½	Ditto	1	37	6	7	33	6			Do.	Ditto.
	4	285-F. ..	1	19½	Ditto	2	36	11	11	32	10			Do.	Ditto.
19/3	1	4-F. ...	2	8	Heavy loam	2	15	6	7	37	14	Six on— 30th April 1920. 11th June 1920. 25th June 1920. 2nd July 1920. 20th July 1920. 28th July 1920.	Eight on— 7th June 1920. 29th June 1920. 17th July 1920. 16th August 1920. 2nd September 1920. 17th September 1920. 28th September 1920 11th October 1920	Wheat	Germination and stand good.
	2	285-F. ...	2	8	Ditto	2	21	4	8	17	8			Do.	Ditto.
	3	4-F. ...	2	8	Ditto	2	34	10	9	22	1			Do.	Ditto.
	4	285-F. ...	2	8	Ditto	2	27	4	8	37	8			Do.	Ditto.
17/20	1	4-F. ...	2	4	Heavy loam	1	36	12	6	39	1	Six on— 5th May 1920. 11th June 1920. 23rd June 1920. 27th June 1920. 12th July 1920. 8th August 1920.	Eight on— 8th June 1920. 21st June 1920. 10th July 1920. 30th July 1920. 23rd August 1920. 7th September 1920. 28th Septomber1920 10th October 1920.	Wheat	Germination good, root rot appeared in sub-plot and destroyed 1½ marlas of the crop.
	2	285-F. ...	2	4	Ditto	2	1	0	7	14	8			Do.	
	3	4-F. ...	2	4	Ditto	2	10	6	8	8	10			Do.	
	4	285-F. ...	2	4	Ditto	1	34	8	6	30	14			Do.	
16/12	1	4-F. ...	1	19	Heavy loam	1	1	1	4	8	7	Nine on— 3rd May 1920. 10th June 1920. 15th June 1920. 26th June 1920. 4th July 1920. 19th July 1920. 20th July 1920. 22nd July 1920. 8th August 1920.	Eight on— 8th June 1920. 23rd June 1920. 1st July 1920. 16th July 1920. 30th July 1920. 26th August 1920. 7th September 1920. 27th September 1920.	Wheat	Germination good, but in sub-plot I it was thin at some places lower leaves began, to wither in sub-plot 4 and most of them fell down.
	2	285-F. ...	1	19	Ditto	1	10	14	5	8	11			Do.	
	3	4-F. ...	1	19	Ditto	1	7	10	4	35	6			Do.	
	4	285-F. ...	1	19	Ditto	1	15	10	5	28	3			Do.	

Average yield per acre.

4-F. ...	29	12½	...	31	26	3	8	21	14
285-F. ...	29	12½	...	30	16	1	8	8	6

Average yield per acre calculated on yield per acre.

	Mds.	Srs.	Cht.
	8	21	4
	8	9	5

Statement No. 30

SHOWING THE COMPARATIVE RESULTS OF 4-F AND 285-F WITH FEWER NUMBER OF WATERINGS GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Number of irrigations with dates.	Previous crop.	Remarks.
16 / 7 & 14	1	4-F. ...	1	19¾	Medium loam	0	20	14	2	4	0	Eight on— 14th April 1920. 14th June 1920. 26th June 1920. 3rd July 1920. 1st August 1920. 11th August 1920. 15th August 1920. 21st August 1920.	Four on— 1st July 1920. 29th July 1920. 7th September 1920. 4th October 1920.	Senji.	Germination good opening of bolls poor, satisfactory crop.
	2	285-F. ...	1	19¾	Do.	0	39	10	3	39	7			Do.	
	3	4-F. ...	1	19¾	Do.	0	23	6	2	14	1			Do.	
	4	285-F. ...	1	19¾	Do.	1	11	8	5	7	4			Do.	
10 / 5	1	4-F. ...	1	15	Loam ...	1	3	8	4	38	14	Eight on— 16th April 1920. 1st June 1920. 18th June 1920. 22nd June 1920. 26th June 1920. 20th July 1920. Ditto. 28th July 1920.	Five on— 20th June 1920. 17th July 1920. 26th August 1920. 20th September 1920. 16th October 1920.	Senji.	Germination good, opening of bolls poor.
	2	285-F. ...	1	15	Do. ...	1	3	8	4	38	14			Do.	
	3	4-F. ...	1	15	Do. ...	0	30	10	3	20	0			Do.	
	4	285-F. ...	1	15	Do. ...	1	5	6	5	7	7			Do.	
6 / 5	1	4-F. ...	1	18¼	Heavy loam	1	11	6	5	14	14	Seven on— 18th April 1920. 16th June 1920. 25th June 1920. 13th July 1920. 1st August 1920. 9th August 1920. 23rd August 1920.	Four on— 10th July 1920. 19th August 1920. 13th September 1920. 10th October 1920	Senji.	Germination good, stand satisfactory, opening of bolls poor.
	2	285-F. ...	1	18¼	Do.	1	22	10	6	21	15			Do.	
	3	4-F. ...	1	18¼	Do.	0	31	14	3	13	5			Do.	
	4	285-F. ...	1	18¼	Do.	1	18	0	6	2	10			Do.	
7 / 16	1	4-F. ...	2	2¼	Light loam	1	2	6	4	0	7	Nine on— 17th April 1920. 12th May 1920. 23rd May 1920. 12th June 1920. 25th June 1920. 13th July 1920. 1st August 1920. 5th August 1920. 8th August 1920.	Four on— 10th July 1920. 19th August 1920. 13th September 1920. 10th October 1920.	Senji	Germination good root rot appeared in sub-plot 2 and destroyed about 3 marlas of the crop, opening of bolls poor.
	2	285-F. ...	2	2¼	Do.	0	37	12	3	22	15			Do.	
	3	4-F. ...	2	2¼	Do.	0	28	7	2	27	10			Do.	
	4	285-F. ...	2	2¼	Do.	0	39	13	3	30	12			Do.	
19 / 18	1	4-F. ...	2	8	Heavy loam	1	16	0	4	26	11	Seven on— 4th May 1920. 12th June 1920. 25th June 1920. 3rd July 1920. 30th July 1920. 10th August 1920. 21st August 1920.	Four on— 30th June 1920. 16th August 1920. 17th September 1920. 11th October 1920.	Wheat	Germination good strand good.
	2	285-F. ...	2	8	Do.	1	6	6	3	34	9			Do.	
	3	4-F. ...	2	8	Do.	1	6	14	3	36	4			Do.	
	4	285-F. ...	2	8	Do.	1	0	14	3	16	4			Do.	
17 / 22	1	4-F. ...	2	1⅝	Medium loam	0	39	10	3	31	13	Six on— 3rd May 1920. 14th June 1920. 23rd June 1920. 26th June 1920. 9th August 1920. 15th August 1920.	Four on— 20th June 1920. 30th July 1920. 3rd September 1920. 10th October 1920.	Wheat	Germination and stand satisfactory, opening of bolls poor.
	2	285-F. ...	2	1⅝	Do.	1	3	0	4	4	12			Do.	
	3	4-F. ...	2	1⅝	Do.	0	31	10	3	1	3			Do.	
	4	285-F. ...	2	1⅝	Do.	1	6	12	4	19	2			Do.	
13 / 17	1	4-F. ...	2	4½	Heavy loam	0	30	10	2	30	11	Eight on— 1st May 1920. 14th June 1920. 27th June 1920. 19th July 1920. 19th July 1920. Ditto. 6th August 1920. 20th August 1920.	Five on— 23rd June 1920. 16th July 1920. 26th August 1920. 19th September 1920. 18th October 1920.	Wheat	Germination satisfactory, opening of bolls poor in sub-plots 1 and 2, but not so poor as in sub-plots 3 and 4.
	2	285-F. ...	2	4½	Do.	1	16	1	5	2	11			Do.	
	3	4-F. ...	2	4½	Do.	1	1	12	3	30	15			Do.	
	4	285-F. ...	2	4½	Do.	1	14	0	4	35	4			Do.	

Average yield per acre.

4-F. ...	28	18½	...	12	38	15	3	23	8
285-F. ...	28	18½	...	16	25	4	4	24	0

Average yield per acre calculated on yield per acre.

Mds.	Srs.	Chs.
3	23	10
4	25	0

Statement No. 31.

ROW TO ROW TEST OF 285-F AND 4-F. AMERICAN COTTON GROWN IN SQUARE 32 DURING KHARIF 1920.

No. of square, block of plot.	No. of lines.	Variety.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Number and dates of waterings.	Remarks.
32 A B.	1	285-F.	Ordinary cultivation. Each variety is into stripped furrow by furrow.	...	..	0	6	13	Seven on—1st July 1920, 12th July 1920, 28th July 1920, 16th September 1920, 1st October 1920 13th October 1920 and 30th October 1920.	
	2	4-F.		..	..	0	9	8		
	3	285-F.		.	...	0	9	5		
	4	4-F.		...	...	0	10	2		
	5	285-F.		...	...	0	8	5		
	6	4-F.		...	...	0	7	3		
	7	285-F.		...	...	0	6	14		
	8	4-F.		...	...	0	8	10		
	9	285-F.		...	..	0	8	11		
	10	4-F.		..	..	0	6	7		
	11	285-F.		...	...	0	7	15		
	12	4-F.		..	...	0	8	1		
	13	285-F.		...	...	0	5	7		
	14	4-F.		...	...	0	6	14		
	15	285-F.		...	...	0	6	2		
	16	4-F.		...	..	0	8	7		
	17	285-F.		...	...	0	5	0		
	18	4-F.		...	...	0	6	15		
	19	285-F.		...	...	0	7	9		
	20	4-F.		...	...	0	7	1		
	21	285-F.		...	...	0	4	6		
	22	4-F.		...	...	0	9	4		
	23	285-F.		...	...	0	5	0		
	24	4-F.		...	...	0	10	10		
	25	285-F.		...	...	0	5	11		
	26	4-F.		...	...	0	10	6		
	13	285-F.		2	...	2	7	2		
	13	4-F.		2	...	2	29	3		

Average yield per acre calculated on yield per acre.	Mds.	Srs.	Chs.
	8	28	8
	10	36	12

Statement No. 32

SHOWING THE COMPARATIVE RESULTS OF 4-F AND 4-F SELECTION No. 1 GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Number of irrigations with dates.	Previous crop.	Remarks.
3 / 17-2	1	4-F ...	1	2	Medium loam	0	22	8	4	3	10	Six on— 14th April 1920 25th May 1920. 15th June 1920. 27th June 1920. 13th July 1920. 30th July 1920.	Six on— 25th June 1920. 12th July 1920. 1st September 1920. 14th September 1920. 30th September 1920. 11th October 1920.	Senji	Germination good, stand good, opening of bolls bad.
	2	Selection No. 1	1	2	Ditto	0	15	6	2	31	13			Do.	Ditto.
	3	4-F ...	1	2	Ditto	0	14	12	2	27	4			Do.	Ditto.
	4	Selection No. 1	1	2	Ditto	0	14	4	2	23	10			Do.	Ditto.
5 / 21	1	4-F ...	2	3	Heavy loam	2	1	0	7	21	6	Seven on— 30th April 1920 9th June 1920. 14th June 1920. 25th June 1920. 19th July 1920. 29th July 1920. 7th August 1920.	Four on— 17th July 1920. 12th August 1920. 12th September 1920. 27th September 1920.	Wheat	Germination good, but in sub-plot 4 the crop was irregular.
	2	Selection No. 1	2	3	Ditto	1	27	10	6	11	10			Do.	Ditto.
	3	4-F ...	2	3	Ditto	1	23	0	5	34	6			Do.	Ditto.
	4	Selection No. 1	2	3	Ditto	1	30	4	6	21	6			Do.	Ditto.
13 / 14	1	4-F ...	2	½	Loam ...	1	1	12	4	4	15	Seven on— 4th May 1920. 14th June 1920. 25th June 1920. 19th July 1920. 28th July 1920. 6th August 1920 20th August 1920.	Five on— 16th July 1920. 11th August 1920. 3rd September 1920. 19th September 1920. 5th October 1920.	Wheat	Germination good stand fairly satisfactory.
	2	Selection No. 1	2	½	Do. ...	1	3	2	4	10	6			Do.	Ditto.
	3	4-F ...	2	½	Do. ...	0	33	10	3	12	13			Do.	Ditto.
	4	Selection No. 1	2	½	Do. ...	0	38	0	3	30	2			Do.	Ditto.
Average outturn per acre.	1	4-F ...	10	11	...	6	16	10	4	34	9	Mds. 4	Srs. 24	Chts. 4	
	2	Selection No. 1	10	11	...	6	8	10	4	28	8	4	14	13	

Statement No. 33

SHOWING THE COMPARATIVE RESULTS OF 4-F AND SPECIAL STRAY No. 2 GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Number of waterings with dates.	Previous crop.	Remarks.
19 / 19	1	4-F ...	2	2¼	Heavy loam	2	11	10	8	26	15	Seven on— 17th May 1920. 24th June 1920. 6th July 1920. 27th July 1920. 30th July 1920. 9th August 1920 16th August 1920.	Four on— 13th May 1920. 24th July 1920. 24th August 1920. 9th September 1920.	Senji and moth.	Germination thin, crop average.
	2	Special stray No. 2.	2	2¼	Ditto	1	14	2	5	4	15			Do.	Ditto.
	3	4-F ..	2	2¼	Ditto	2	2	14	7	33	13			Do	Ditto.
	4	Special stray No. 2.	2	2¼	Ditto	1	25	8	6	8	0			Do.	Ditto.
Average outturn per acre.	1	4-F ...	4	4½	...	4	14	8	8	10	6	Mds. 8	Srs. 10	Chts. 6	
	2	Special stray No. 2.	4	4½	...	2	39	10	5	26	8	5	26	8	

Statement No. 84

SHOWING THE COMPARATIVE RESULTS OF G. I. MOLLISONI 24 AND 4-F. GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Variety.	Area		Soil.	Actual outturn.			Outturn per acre.			Number of hoeings with dates.	Number of waterings with dates.	Previous crop.	Remarks.
			Kanals.	Marlas.		Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.				
11 / 9	1	Mollisoni 24 ...	2	0	Light loam ..	2	3	12	8	15	0	Six on— 28th April 1920 12th June 1920. 25th June 1920. 4th July 1920. 28th July 1920. 5th August 1920	Five on 1st July 1920. 30th July 1920. 26th August 1920. 20th September 1920. 5th October 1920.	Wheat	Germination good, stand good.
	2	4-F ...	2	0	Ditto ...	1	14	10	5	18	8			Do.	Ditto.
	3	Mollisoni 24 ...	2	0	Ditto ...	1	24	5	6	17	4			Do.	Ditto.
	4	4-F ...	2	0	Ditto ...	1	5	10	4	22	8			Do.	Ditto.
13 / 7	1	Mollisoni 24 ...	2	5½	Medium loam	1	20	8	5	15	2	Ten on— 2nd May 1920. 16th May 1920. 15th June 1920. 24th June 1920. 24th June 1920. 28th July 1920. 2nd August 1920 8th August 1920 18th August 1920 29th August 1920	Four on— 29th July 1920. 26th August 1920. 15th September 1920. 5th October 1920.	Wheat	Germination and stand good.
	2	4-F ...	2	5½	Ditto	0	32	6	2	33	13			Do.	Ditto.
	3	Mollisoni 24 ...	2	5½	Ditto	1	37	9	6	32	3			Do.	Ditto.
	4	4-F ...	2	5½	Ditto	1	5	2	3	38	11			Do.	Ditto.
19 / 12	1	Mollisoni 24 ...	1	15	Loam ..	2	27	0	12	9	3	Seven on— 28th April 1920 11th June 1920. 23rd June 1920. 26th June 1929. 28th July 1920. 9th August 1920 22nd August 1920.	Five on— 19th June 1920 12th August 1920. 9th September 1920. 29th September 1920. 15th October 1920.	Gram	Germination and stand good.
	2	4-F ...	1	15	Do. ...	1	19	4	6	30	13			Do.	Ditto.
	3	Mollisoni 24 ...	1	15	Do. ...	2	16	0	10	38	13			Do.	Ditto.
	4	4-F ...	1	15	Do. ...	1	23	2	7	8	9			Do.	Ditto.
		Average yield per acre.													
	1	Mollisoni 24 ...	12	1		12	9	2	8	4	5				
	2	4-F ...	12	1		7	20	2	4	39	4				

Average yield per acre.	Mds.	Srs.	Chts.
Mollisoni 24	8	14	9
4-F	5	5	8

Statement No. 35

SHOWING THE COMPARATIVE RESULTS OF G. I. MOLLISONI 24 AND F. S. B. LEAVED (G. SARGUINEUM) GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Variety.	Area.		Soil.	Actual outturn.			Outturn per acre.			Number of hoeings with dates.	Number of irrigations with dates.	Previous crop.	Remarks.
			Kanals.	Marlas.		Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.				
7 / 6	1	Mollisoni 24 ...	2	2½	Calcarious loam	0	37	4	3	20	4	Eight on— 5th May 1920. 22nd May 1920. 23rd May 1920. 28th June 1920. 13th July 1920. 31st July 1920. 9th August 1920 18th August 1920.	Five on— 25th June 1920. 10th July 1920. 6th August 1920. 1st September 1920. 1st October 1920	Wheat	Germination good, crop average.
	2	F. S. B. L. Sanguineum.	2	2½	Ditto	0	37	5	3	20	7			Do.	Ditto.
	3	Mollisoni 24 ...	2	2½	Ditto	0	39	3	3	27	8			Do.	Ditto.
	4	F. S. B. L. Sanguineum.	2	2½	Ditto	1	17	0	5	14	9			Do.	Ditto.
17 / 21	1	Mollisoni 24 ...	2	1¼	Heavy loam...	1	13	8	5	7	8	Six on— 29th April 1920. 13th June 1920. 27th June 1920. 25th July 1920. 26th July 1920. 29th July 1920.	Five on— 24th June 1920. 22nd July 1920. 25th August 1920. 9th September 1920. 7th October 1920.	Gram	Germination and stand good.
	2	F. S. B. L. Sanguineum.	2	1¼	Ditto ...	2	6	14	8	16	15			Do.	Ditto.
	3	Mollisoni 24 ...	2	1¼	Ditto ...	2	7	0	8	17	7			Do.	Ditto.
	4	F. S. B. L. Sanguineum.	2	1¼	Ditto ...	2	30	8	10	28	9			Do.	Ditto.
		Average yield per acre.										Average yield per acre calculated on yield per acre.			
	1	Mollisoni 24 ...	8	7½	...	5	16	15	5	7	3		Mds. 5	Srs. 8	Chts. 3
	2	F. S. B. L. Sanguineum.	8	7½	...	7	11	11	6	38	10		7	0	2

Statement No. 36

SHOWING THE COMPARATIVE RESULTS OF G. N. ROSEA 87-A AND G.I. MOLLISONI 24, GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION DURING KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Variety.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Number of irrigations with dates.	Previous crop.	Remarks.
7/24	1	Mollisoni 24 ...	2	1¾	Medium Loam.	2	8	9	8	19	6	Nine on— 17th April 1920, 13th May 1920, 28th May 1920, 13th June 1920, 25th June 1920, 19th July 1920, 22nd July 1920, 28th July 1920 and 5th August 1920.	Five on— 10th July 1920, 31st August 1920, 13th September 1920, 29th September 1920 and 10th October 1920.	Gram	Germination good, stand very good.
	2	Rosea 87-A ...	2	1¾		1	32	13	6	39	1				
	3	Mollisoni 24 ...	2	1¾		1	33	11	7	2	6				
	4	Rosea 87-A ...	9	1¾		2	8	11	8	19	14				
5/20	1	Mollisoni 24 ...	2	4	Loam.	2	19	2	9	0	7	Eight on— 4th May 1920, 21st June 1920, 25th June 1920, 20th July 1920, 25th July 1920, 30th July 1920, 6th August 1920, and 15th August 1920.	Four on— 17th July 1920, 2nd August 1920, 20th September 1920 and 5th October 1920.	Wheat	Germination and stand good.
	2	Rosea 87-A ...	2	4		2	15	4	8	26	6				
	3	Mollisoni 24 ...	2	4		2	0	12	7	13	10				
	4	Rosea 87-A ...	2	4		2	8	10	8	2	4				

AVERAGE OUTTURN PER ACRE.

AVERAGE OUTTURN PER ACRE CALCULATED ON YIELD PRE ACRE.

										Mds.	Srs.	Chtks.
1	Mollisoni 24.	8	11½		8	22	2	7	39	2	7	38	15
2	Rosea 87-A.	8	11½		8	25	6	8	2	3	8	1	14

Statement No. 37.

STATEMENT SHOWING THE RESULTS OF EARLY IRRIGATIONS (TILL JULY) TO 4-F AMERICAN COTTON DURING KHARIF 1920-22.

Plot and square.	Sub-plot.	Treatment.	Area in kanals.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Irrigation in inches raunidated 11th April 1920.	Irrigations after sowing. Number.	Irrigations after sowing. Dates.	Irrigations after sowing. Inches.	Rain fall till last watering.	Remarks.
10/A_1a	1	*Ordinary cultivation.* Irrigation after every 10 days.	2	29	4	2	37	2·98	11	4th May 1920 ...	30·83	..	The first irrigation, in the case of 10, 20 and 30 days, experiment was given 20, 40 and 60 days respectively after sowing.
	2	Ditto 20 days.	2	18	12	1	35	2·98	7	14th May 1920 ..	19·75	...	
	3	Ditto 30 days.	2	12	4	1	9	2·98	5	24th May 1920, 3rd June 1920.	5·01	...	
	4	No water till July.	2	11	0	1	4	2·98	4	13th June 1920 ...	12·13	...	
A_2a	1	Irrigation after every 20 days.	2	16	12	1	27	...	7	24th June 1920, 3rd July 1920.	19·12	..	
	2	Ditto 10 days.	2	18	0	1	32	...	11	13th July 1920 ...	30·20	...	
	3	No water till July.	2	10	0	1	0	...	4	2nd and 3rd August 1920.	11·50	...	
	4	Irrigation after every 30 days.	2	10	4	1	1	...	5	24th August 1920, 29th September 1920.	14·38	...	

AVERAGE YIELD PER ACRE.

		Maunds.	Seers.
Irrigation after every	10 days	2	14½
Ditto	20 days	1	31
Ditto	30 days	1	5
No water till July		1	2

Statement No. 38

SHOWING THE RESULTS OF WATERING EXPERIMENTS WITH 4-F COTTON GROWN IN SQUARE 43 DURING KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of waterings with dates till July.	Number of waterings with dates after July.	Remarks.
43/A-1	1	Watering after every 10 days till July	2	0	2	8	2	8	32	8	Eight on— 5th May 1920, 15th May 1920, 25th May 1920, 4th June 1920, 12th June 1920, 22nd June 1920, 2nd July 1920, and 12th July 1920.	Three on 30th August 1920, 11th September 1920, 4th and 5th October 1920.	
	2	Do. do. 20 do. do.	2	0	1	7	13	4	31	4		Ditto ditto.	
	3	Do. do. 30 do. do.	2	0	0	31	10	3	6	8		Ditto ditto.	
	4	No water till July	2	0	0	22	14	2	11	8		Ditto ditto.	
43/A-2	1	Watering after 20 days till July	2	0	1	14	13	5	19	4		Ditto ditto.	
	2	Do. do. 10 do. do.	2	0	1	5	0	4	2	0		Ditto ditto.	
	3	No water till July	2	0	0	22	5	2	9	4		Ditto ditto.	
	4	Watering after every 30 days till July	2	0	0	19	6	1	37	8		Ditto ditto.	
43/A-3	1	Do. do. 30 do. do.	2	0	0	37	6	3	29	8	Four on— 25th May 1920, 12th June 1920, 2nd July 1920, and 12th July 1920.	Ditto ditto.	
	2	Do. do. 20 do. do.	2	0	0	32	9	3	10	4		Ditto ditto.	
	3	Do. do. 10 do. do.	2	0	1	14	11	5	18	12		Ditto ditto.	
	4	No water till July	2	0	0	39	14	3	39	8		Ditto ditto.	
43/A-4	1	Do. do.	2	0	0	21	1	2	4	4		Ditto ditto.	
	2	Watering after every 30 days till July	2	0	0	20	0	2	0	0		Ditto ditto.	
	3	Do. do. 20 do. do.	2	0	0	29	2	2	36	8	Two on— 12th June 1920 and 12th July 1920.	Ditto ditto.	
	4	Do. do. 10 do. do.	2	0	1	13	9	5	14	4		Ditto ditto.	
43/A-5	1	Do. do. 30 do. do.	2	0	0	20	0	2	0	0		Ditto ditto.	
	2	No water till July	2	0	0	10	1	1	0	4		Ditto ditto.	
	3	Watering after every 10 days till July	2	0	0	38	10	3	34	8	One on— 12th July 1920.	Ditto ditto.	
	4	Do. do. 20 do. do.	2	0	1	1	14	4	7	8		Ditto ditto.	

N.B.—Plots receiving waterings after 10, 20, 30 days, and no water till July, received same numbers of waterings and on the same dates respectively as the sub-plot of plot $\frac{43}{A\text{-}1}$

AVERAGE YIELD PER ACRE.

	Kanals.	Marlas.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.
Watering after every 10 days till July	10	0	7	0	0	5	24	0
Do. do. 20 do. do.	10	0	5	6	3	4	4	$15\frac{1}{5}$
Do. do. 30 do. do.	10	0	3	8	6	2	22	$11\frac{1}{5}$
No water till July	10	0	2	36	3	2	12	$15\frac{1}{5}$

AVERAGE YIELD PER ACRE.

	Mds.	Srs.	Chtks.
Watering after every 10 days till July	5	24	0
Do. do. 20 do. do.	4	4	$15\frac{1}{5}$
Do. do. 30 do. do.	2	22	$11\frac{1}{5}$
No water till July	2	12	$15\frac{1}{5}$

Ploughings	Raja plough only once.
Harrowings	2
Sohagoings	3
Hoeings	9 to all the plots.

Details of waterings.
- 11 waterings to plot, watered after every 10 days till July.
- 7 Do. do. do. do. 20 do. do.
- 5 Do. do. do. do. 30 do. do.
- 4 Do. do, do. do. no water till July.

Picking began on 20th October 1920 and finished on 16th January 1921.

Statement No. 39

SHOWING THE RESULTS OF WATERING EXPERIMENTS WITH 4-F. COTTON GROWN IN SQURE 43, KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of waterings with dates till July.	Number of waterings with dates after July.	Remarks.
43 A-6	1	Waterings after every week after July	2	0	0	12	0	1	8	0	One on 8th July 1920 ..	Thirteen on— 2nd and 3rd August 1920, 24th August 1920, 30th August 1920, 6th September 1920, 12th September 1920, 22nd September 1920, 29th September 1920, 6th October 1920, 13th October 1920, 20th October 1920, 27th October 1920, 3rd November 1920, 19th November 1920	
	2	Do. do. 4 weeks after July	2	0	0	10	4	1	1	0	Ditto ...	Four on— 2nd and 3rd August 1920, 12th September 1920, 22nd October 1920, 9th November 1920.	
	3	Do. do. 2 do. do. ...	2	0	0	13	8	1	14	0	Ditto ...	Seven on— 2nd and 3rd August 1920, 30th August 1920, 12th September 920, 2nd October 1920, 16th October 1920, 30th October 1920, 13th November 1920.	
	4	Do. do. 4 do. do. ...	2	0	0	15	8	1	22	0	Ditto ...	Same as in sub-plot No. 2 of plot 6,	
43 A-7	1	Do. do. 2 do. do. ...	2	0	0	8	0	0	32	0	Ditto ...	Same as in sub-plot No. 3 of plot No. 6.	
	2	Do. do. 3 do. do. ...	2	0	0	8	8	0	34	0	Ditto ...	Four on— 2nd and 3rd August 1920, 6th September 1920, 27th October 1920, 17th November 1920.	
	3	Do. do. 4 do. do. ...	2	0	0	9	12	0	39	0	Ditto ...	Same as in sub-plot No. 2 of plot No. 6.	
	4	Do. do. 2 do. do. ...	2	0	0	14	4	1	17	0	Ditto ...	Same as in sub-plot No. 3 of plot No. 6.	
43 A-8	1	Do. do. 3 do. do. ...	2	0	0	13	0	1	12	0	Ditto ...	" " " " " 2 " " " 7.	
	2	Do. do. 2 do. do. ...	2	0	0	8	12	0	35	0	Ditto ...	" " " " " 3 " " " 6.	
	3	Do. do. week after July ...	2	0	0	10	4	1	1	0	Ditto ...	" " " " " 1 " " " 6.	
	4	Do. do. 3 weeks after July ...	2	0	0	13	2	1	12	8	Ditto ...	" " " " " 2 " " " 7.	
43 A-9	1	Do. do. 4 do. do. ...	2	0	0	19	8	1	38	0	Ditto ...	" " " " " 2 " " " 6.	
	2	Do. do. week after July ...	2	0	0	17	0	1	28	0	Ditto ...	" " " " " 1 " " " 6.	
	3	Do. do 3 weeks after July ...	2	0	0	17	0	1	28	0	Ditto ...	" " " " " 2 " " " 7.	
	4	Do. do. week after July ...	2	0	0	25	7	2	21	12	Ditto ..	" " " " " 1 " " " 6.	

AVERAGE YIELD PER ACRE—

Watering after every week after July	8	0	1	24	11	1	24	11
Do. do. 2 weeks do. do.	8	0	1	4	8	1	4	8
Do. do. 3 do. do. do.	8	0	1	11	10	1	11	10
Do. do. 4 do. do. do.	8	0	1	15	0	1	15	0

AVERAGE YIELD PER ACRE.

	Mds.	Srs.	Chtks.
Wertering after every week after July ...	1	24	11
Do. do. 2 weeks do. ...	1	4	8
Do. do. 3 do. do. ...	1	11	10
Do. do. 4 do. do. ..	1	15	0

Ploughings ... ... Raja plough only once.
Harrewings 3
Sohagaings 4
Hoeings ... ... 10 to all the plots.
Picking began on 6th December 1920 and finished on 20th January 1921.

Details of warterings.
- 14 waterings to plot after every week.
- 8 ditto ditto 2 weeks.
- 5 ditto ditto 3 do.
- 5 ditto ditto 4 do.

Statement No. 40

SHOWING THE RESULTS OF 4-F WITH ORDINARY WATERINGS UP TO JULY *VERSUS* NO WATERING TILL JULY AND AFTERWARDS WITH EQUAL NUMBER OF WATERINGS GROWN WITH TENANTS AT LYALLPUR AGRICULTURAL STATION, KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Treatment.	Area. Kanals.	Area. Marlas.	Soil.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Number of hoeings with dates.	Number of irrigations with dates.	Previous crop.	Remarks.
3 / 18	1	Ordinary watering	2	1½	Medium loam ...	0	17	6	1	27	0	Nine on— 3rd May 1920, 15th June 1920, 16th June 1920, 26th June 1920, 13th July 1920, 30th July 1920, 8th August 1920, 19th August 1920, 23rd August 1920.	Five on — 13th July 1920, 6th August 1920, 20th August 1920, 14th August 1920, 11th October 1920. *Note.*—Sub-plots 1 and 3 received 1 more watering on 13th June 1920	Wheat	Germination fairly satisfactory, crop irregular especially in sub-plot 4, stand of the crop poor.
	2	Watering delayed till July	2	1½	Ditto ...	0	18	14	1	32	12			Do.	
	3	Ordinary watering	2	1½	Ditto ...	0	14	6	1	15	6			Do.	
	4	Watering delayed till July	2	1½	Ditto ...	0	9	14	0	38	1			Do.	
6 / 4	1	Ordinary watering	2	4½	Loam ...	0	31	12	2	34	2	Eight on — 9th May 1920, 17th June 1920, 25th June 1920, 12th July 1920, 31st July 1920, 9th August 1920, 23rd August 1920, and 30th August 1920.	Four on— 10th July 1920, 19th August 1920, 1st September 1920, 30th September 1920. *Note.*—Sub-plots 1 and 3 received one more watering on 25th June 1920.	Gram	
	2	Watering delayed till July	2	4½	Do. ...	0	37	6	3	14	6			Do. ...	
	3	Ordinary watering	2	4½	Do. ...	1	28	12	6	7	3			Do. ...	Germination good, sub-plots 2 and 4 dicidedly superior in the stand of the crop.
	4	Watering delayed till July	2	4½	Do. ...	1	26	10	5	39	9			Do. ...	
13 / 18	1	Ordinary watering	2	2	Heavy loam ...	0	38	12	3	27	10	Eight on— 14th April 1920, 14th June 1920, 23rd June 1920, 26th June 1920, 19th July 1920, 29th July 1920, 8th August 1920, 20th August 1920.	Four on — 16th July 1920, 11th August 1920, 8th September 1920, 5th October 1920. *Note.*—Sub-plots 1 and 3 received one more watering on 19th June 1920.	Senji...	
	2	Watering delayed till July	2	2	Ditto ...	0	36	14	3	20	7			Do ...	
	3	Ordinary watering	2	2	Ditto ...	0	29	6	2	31	14			Do. ...	Germination good and stand good, opening of the bolls poor.
	4	Watering delayed till July	2	2	Ditto ...	0	30	0	2	34	4			Do. ...	

Average yield per acre.

													Average yield per acre calculated on yield per acre. Mds.	Srs.	Chts.
1	Ordinary watering	12	16	...	5	0	6	3	5	4			3	3	14
2	Watering delayed till July	12	16	...	4	39	10	3	4	12			3	3	4

Statement No. 41.

RESULTS OF CULTURAL EXPERIMENTS WITH AMERICAN COTTON 4-F. GROWN IN SQUARE 27, KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Variety.	Treatement.	Area in acres.	Actual outturn.			Outturn per acre.			Number of waterings with dates.	Number of hoeings with dates.	Previous crop.	Remarks.
					Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.				
27/D	1	4-F.	Ploughed 6″ deep with Rajah plough ...	½	1	37	3	3	34	6	Five waterings on—	Bar Harrow—16th May 1920.	Wheat.	Harrowings 2.
	2	4-F.	Ploughed 6″ deep with Rajah plough and then stirred with Munna to 9″	½	2	6	12	4	13	8		Bar Harrow—7th June 1920.		Sohagaings 3.
	3	4-F.	Ploughed 6″ deep ...	½	2	9	13	4	19	10	1st—15th July 1920.	Drill Harrow—13th June 1920.		
	4	4-F.	Ploughed 6″ deep and then stirred with munna 9″	½	2	1	10	4	3	4	2nd—10th August 1920.	Drill Harrow—25th June 1920.		
	5	4-F.	Ploughed 6″ deep	½	2	8	6	4	16	12	3rd—6th September 1920.	Horse-hoe and Drill harrow—18th July 1920.		
	6	4-F.	Ploughed 9″ deep	½	2	16	11	4	33	6	4th—28th September 1920.	Horse-hoe—5—6th August 1920.		
	7	4-F.	Ploughed 6″ deep	½	1	39	3	3	38	6	5th—22nd October 1920.	Lyallpur hoe—21st August 1920.		
	8	4-F	Ploughed 9″ deep	½	2	0	13	4	1	10				

AVERAGE YIELD PER ACRE.

	Mds.	Srs.	Chs.
Ploughed 6″ deep.	4	7	4½
„ 9″ „	4	17	8
Ploughed 6″ deep and stirred to 9″	4	8	6

Statement No. 42.

RESULTS OF RIDGING EXPERIMENTS WITH 4-F AMERICAN COTTON GROWN IN SQUARE 26, KHARIF 1920.

No. of plot.	No. of sub-plot.	Treatment.	Area.	Actual outturn. Maunds.	Seers.	Chataks.	Outturn per acre. Maunds.	Seers.	Chataks.	Dates of waterings.	Irrigation in inches. After ridging.	Date of sowing.	Remarks.
			Acre.										
A 1 1	a_1	Drilled on flat		0	23	13½	2	15	6	5 waterings—		3rd May 1920	Ploughings 2
	a_2	Ditto Ridged afterwards ...		0	18	4	1	33	0	1st—22nd May 1920	...	Ditto	Harrowing 1
	b_1	Ditto		0	19	11½	1	36	6	2nd—7th July 1920	...	Ditto	Sohagaings 4
	b_2	Ditto Ridged afterwards...		0	21	14	2	7	8	3rd—30th August 1920	...	Ditto	Hoeings 10
A 2 1	a_1	Ditto		0	19	6	1	37	8	4th—28th September 1920.	3·14	Ditto	
	a_2	Ditto Ridged afterwards...		0	24	15	2	19	12	5th—4th November 1920.	2·4	Ditto.	
	b_1	Ditto	¼	0	17	14	1	31	8	...	4·07	Ditto.	
	b_2	Ditto Ridged afterwards ..		0	23	14	2	15	8	4 waterings—	2·5	Ditto.	
A 3 1	a_1	Ditto		0	5	4	0	21	0	1st—7th July 1920	3·14	11th April 1920 ..	Ploughings 2
	a_2	Ditto Ridged afterwards...		0	6	11	0	26	12	2nd—30th August 1920.	2·77	Ditto ...	Harrowings 4
	b_1	Ditto		0	17	9	1	30	4	3rd—28th September 1920.	3·70	Ditto ...	Sohagiangs 6
	b_2	Ditto Ridged afterwards ..		0	16	8	1	26	0	4th—5th November 1920.	2·77	Ditto ...	Hoeings 10
A 4 1	a	Ditto	½	1	2	15½	2	5	15	4 waterings—	..	Ditto ...	Ploughings ... ... 2 Harrowings ... ... 3 Sohagaings ... ... 5 Hoeings 8
	b	Ditto	½	1	12	8	2	25	0	1st—7th July 1920	...	Ditto ...	
										2nd—30th August 1920			Dates of picking 20th November 1920—6th January 1921.
										3rd—28th September 1920.			
										4th—22nd October 1920			

AVERAGE YIELD PER ACRE.

Drilled on flat	1	35	6
Ditto and ridged afterwards	1	34	10

Statement No. 43

SHOWING THE RESULTS OF 4-F COTTON SOWN ON FLAT *VERSUS* SOWN ON FLAT RIDGED AFTERWARDS ON TENANTS' LAND AT LYALLPUR AGRICULTURAL STATION, KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Flat. Area. Kanals.	Flat. Area. Marlas.	Flat. Actual outturn. Maunds.	Flat. Actual outturn. Seers.	Flat. Actual outturn. Chataks.	Flat. Outturn per acre. Maunds.	Flat. Outturn per acre. Seers.	Flat. Outturn per acre. Chataks.	No. of square and plot.	No. of sub-plot.	Ridging. Area. Kanals.	Ridging. Area. Marlas.	Ridging. Actual outturn. Maunds.	Ridging. Actual outturn. Seers.	Ridging. Actual outturn. Chataks.	Ridging. Outturn per acre. Maunds.	Ridging. Outturn per acre. Seers.	Ridging. Outturn per acre. Chataks.	Previous crop.	Remarks.
7 / 25	2	1	17½	0	30	2	3	8	8	7 / 25	1	1	17½	0	34	10	3	27	11	Gram ...	Medium loam. Hoeing—ten on 22nd April 1920, 18th May 1920, 23rd May 1920, 13th June 1920, 25th June 1920, 24th July 1920, 25th July 1920, 28th July 1920, 8th August 1920, 10th August 1920.
	4	1	17½	1	9	6	5	10	10		3	1	17½	0	24	4	2	23	7	Do. ...	Waterings—three on 23rd July 1920, 31st August 1920, 29th September 1920. Germination satisfactory.
3 / 13	2	2	2	0	16	8	1	22	13	3 / 13	1	2	2	0	15	8	1	19	0	Wheat ...	Medium loam. Hoeings—seven on 29th April 1920, 16th June 1920, 27th June 1920, 26th July 1920, 29th July 1920, 6th August 1920 and 23rd August 1920.
	4	2	2	0	20	4	1	37	2		3	2	2	0	16	12	1	3	13	Do. ..	Waterings -five on 25th June 1920, 24th July 1920, 20th August 1920, 14th September 1920, 11th October 1920. Germination satisfactory, crop below average. Ridges were formed in sub-plots 1 & 3 on 10th August 1920.
19 / 28	2	2	8	0	34	12	2	35	13	19 / 23	1	2	8	1	6	8	3	35	0	Toria	Heavy loam— Hoeings—seven on 13th April 1920, 12th June 1920, 23rd June 1920, 26th June 1920, 8th, August 1920, 10th August 1920 and 21st August 1920.
	4	2	8	0	26	2	2	7	1		3	2	8	0	37	14	3	3	4	Do. ...	Waterings—five on 19th June 1920, 31st July 1920, 27th August 1920, 10th September 1920 and 7th October 1920 Germination good, crop average.

AVERAGE OUTTURN PER ACRE.

		Mds.	Srs.	Chtks.
Flat	...	12	15	4 17
Ridging	...	12	15	4 15

AVERAGE OUTTURN PER ACRE.

		Mds.	Srs.	Chtks.
Flat	...	2	33	10
Ridging	...	2	29	8

Statement No. 44

SHOWING THE NUMBER AND INCHES OF IRRIGATIONS GIVEN TO THE RIDGING *VERSUS* FLAT COTTON EXPERIMENTAL PLOTS IN TENANTS' AREA, KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Whether ridged or flat.	Area. Kanals.	Area. Marlas.	No. dates and amount in inches irrigations after ridging. 1st irrigation in inches.	2nd irrigation in inches	3rd irrigation. in inches.	Total irrigation in inches after ridging.	Date of ridging.	Remarks.
7 / 2	...	...	...	...	31st August 1920.	29th September 1920		...	...	
7 / 25	1	Ridged ...	1	17½	4·23	4·17	...	8·40	25th July 1920.	
	2	Flat ...			4·50	4·17	...	8·67	Ditto.	
	3	Ridged ...			3·50	3·78	...	7·30	Ditto.	
	4	Flat ..			4·09	4·17	...	8·26	Ditto.	
3 / 13					14th September 1920	11th October 1920.				
	1	Ridged ...	2	2	2·82	4 82	...	7·64	23rd August 1920.	
	2	Flat ...			3·07	5·04	...	8·11	Ditto.	
	3	Ridged ...			2·82	4·38	...	7·20	Ditto.	
	4	Flat ...			3·55	5 04	...	859	Ditto.	
19 / 23					27th August 1920.	10th September 1920	7th October 1920.			
	1	Ridged ...	2	9	4·32	3·17	3·21	10·70	10th August 1920.	
	2	Flat ...			5·66	3·49	3 62	12·77	Ditto.	
	3	Ridged ...			4·72	3·24	3·48	11·44	Ditto.	
	4	Flat ...			5·31	3·98	3·81	13·10	Ditto.	

AVERAGE TOTAL IRRIGATION IN INCHES.

Ridged plots	...	8·78
Flat plots	...	9·91

Statement No. XLV

SHOWING THE RESULTS OF SOWING COTTONS IN LINES *VERSUS* BROADCAST WITH TENANTS AT L. A. S. DURING KHARIF 1920.

No. of square and plot.	No. of sub-plot.	Broadcast. Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	No. of square and plot.	No. of sub-plot.	Lines. Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Previous crop.	Remarks.
										4 F											LIGHT LOAM.
11 / 10	1	1	15	0	21	14	2	20	0	11 / 10	2	1	15	0	19	6	2	8	9	Wheat ...	Hoeings eight on 28th April 1920, 12th June 1920, 22nd June 1920, 25th June 1920, 28th July 1920, 2nd August 1920, 7th August 1920, in broadcast plots, hoed desi plough once on 1st August 1920, line plots.
...	3	1	15	0	15	2	1	29	2	...	4	1	15	0	24	14	2	33	11	Do. ...	Waterings four on 20th June 1920, 30th July 1920, 8th September 1920, 27th September 1920. germination fair.
																					MEDIUM LIGHT LOAM.
16 / 22	1	2	1½	0	15	8	1	20	2	16 / 22	2	3	1½	0	13	14	1	13	13	Gram ...	Hoeings seven on 22nd April 1920, 25th June 1920, 26th June 1920, 19th July 1920, 30th July 1920, 6th August 1920 and 21st August 1920 in broadcast plots ploughed with desi plough once on 5th August 1920, line plots.
...	3	2	1½	0	8	12	0	33	15	...	4	2	1½	0	9	2	0	35	6	Do. ...	Waterings four on 16th July 1920, 11th August 1920, 19th September 1920, 15th October 1920. Germination fairly satisfactory, crop below average.
																					AVERAGE OUTTURN PER ACRE CALCULATED ON YIELD PER ACRE.
																					Mds. Srs. Ch.
Broadcast		7	12½	1	21	4	1	24	4	Lines		7	12½	1	27	4	1	30	8	...	Broad cast ... 1 25 13
																					Lines 1 32 14
																					MOLLISONI 24.
16 / 17 & 24	1	2	2½	1	12	12	4	39	12	16 / 17 & 24	2	2	2½	1	0	12	3	34	5	Gram and senji ...	Hoeings seven on 14th April 1920, 15th June 1920, 26th June 1920, 19th July 1920, 20th July 1920, 29th July 1920, 7th August 1920 in line plots only. Broadcast plots ploughed with desi plough once on 19th July 1920.
...	3	2	2½	1	0	10	3	33	13	...	4	2	2½	1	8	14	4	25	1	Do. ...	Watering four on 16th July 1920, 11th August 1920, 19th September 1920, and 5th October 1920. Germination satisfactory.
																					AVERAGE OUTTURN PER ACRE CALCULATED ON YIELD PER ACRE.
																					Mds. Srs. Ch.
Broadcast		4	4½	2	13	6	4	16	13	Lines.		4	4½	2	9	10	4	9	11	...	Broadcast ... 4 16 12
																					Lines ... 4 9 11

Statement No. XLVI

SHOWING THE RESULTS OF TORIA VARIETIES GROWN IN SQUARE 32 DURING 1920-21.

No. of square and block and plot.	No. of sub-plot.	Variety.	Treatment.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Irrigation with dates.	Remarks.
32—1 B	a 1	Early variety ...	No harrowing after sowing ...	2	0	2	14	3½	9	16	14	Two on— 18th October 1920 and 25th November 1920.	The germination was uniform and regular in harrowed portions and patchy and not uniform in unharrowed portion. There was much irregularity in ripening in case of late variety.
	a 2	Ditto ...	Harrowing ditto	2	0	2	5	4	8	21	0		
	b 1	Late variety ...	No harrowing ditto ...	2	0	1	33	9	7	14	4		
	b 2	Ditto ...	Harrowing ditto ...	2	0	2	2	9	8	10	4		
32—2 B	a 1	Early variety ...	No harrowing ditto ...	2	0	2	25	15	10	23	12	One on— 18th October 1920.	
	a 2	Ditto ...	Harrowing ditto ...	2	0	2	9	11	8	38	12		
	b 1	Late variety ...	No harrowing ditto ...	2	0	2	15	10	9	22	8		
	b 2	Ditto ...	Harrowing ditto ...	2	0	2	9	12	8	39	0		
32—3 B	a 1	Early variety ...	No harrowing ditto ...	2	0	2	32	3	11	8	12	Two on— 18th October 1920 and 25th November 1920.	
	a 2	Ditto ...	Harrowing ditto ...	2	0	2	11	6	9	5	8		
	b 1	Late variety ...	No harrowing ditto ...	2	0	2	9	10	8	38	8		
	b 2	Ditto ...	Harrowing ditto ...	2	0	2	9	8½	8	38	2		
32—4 B	a 1	Early variety ...	No harrowing ditto ...	2	0	2	22	10	10	10	8	One on— 18th October 1920.	
	a 2	Ditto ...	Harrowing ditto ...	2	0	2	14	9	9	18	4		
	b 1	Late variety ...	No harrowing ditto ...	2	0	2	12	8	9	10	0		
	b 2	Ditto ...	Harrowing ditto ...	2	0	2	10	11	9	2	12		
32—5 B	a 1	Early variety ...	No harrowing ditto ...	2	0	2	30	10	11	2	8	Two on— 18th October 1920 and 25th November 1920.	
	a 2	Ditto ...	Harrowing ditto ...	2	0	2	20	9	10	2	4		
	b 1	Late variety ...	No harrowing ditto ...	2	0	2	15	7	9	21	12		
	b 2	Ditto ...	Harrowing ditto ...	2	0	2	16	10	9	26	8		
32—6 B	a 1	Early variety ...	No harrowing ditto ...	2	0	2	25	0	10	20	0	One on— 18th October 1920.	
	a 2	Ditto ...	Harrowing ditto ...	2	0	2	16	5	9	25	4		
	b 1	Late variety ...	No harrowing ditto ...	2	0	2	32	1	11	8	4		
	b 2	Ditto ...	Harrowing ditto ...	2	0	3	0	½	12	0	2		

												Average yield per acre calculated on yield per Mds.	Srs.	Ch.
Average yield per acre with one irrigation.														
	Early variety ...	No harrowing after sowing ...	6	0	7	33	9	10	18	1⅓		10	18	1⅓
	Ditto ...	Harrowing ditto ...	6	0	7	0	9	9	14	1⅓		9	14	1⅓
	Late variety ...	No harrowing ditto ...	6	0	7	20	3	10	0	4		10	0	4
	Ditto ...	Harrowing ditto ...	6	0	7	20	7½	10	0	10		10	0	10
Average yield per acre with two irrigations.														
	Early variety ...	No harrowing after sowing ...	6	0	7	37	⅓	10	22	11⅓		10	22	11⅓
	Ditto ...	Harrowing ditto ...	6	0	6	37	3	9	9	9⅓		9	9	9⅓
	Late variety ...	No harrowing ditto ...	6	0	6	18	10	8	24	13⅓		8	24	13⅓
	Ditto ...	Harrowing ditto ...	6	0	6	28	11½	8	38	4⅔		8	38	4⅔

Raja plough 1
Horse Hoe 5
Harrowing with Bar Harrow ... 1 only where it is required.
Sohagaings ... ... 2.
Date of sowing ... ... Plots 1, 2 and 3 were sown on 2nd September 1920 a d 4. 5, 6 on 4th September 1920.
Date of watering ... . Plots 1, 3, 5 received two waterings on 18th October 192. and 25th November 1920.
Ditto ... ... Plots 2, 4 and 6 received one watering on 18th October 1920.
Date of harvesting ... . Early variety on 1st to 3rd January 1920 and late on 9th-10th January 1921.

Statement No. XLVII.

COMPARATIVE TEST OF EARLY RAYA No. 3 *VERSUS* TORIA (LOCAL) GROWN ON TENANTS' LAND, YEAR 1920-21.

No. of square and plot.	No. of sub-plot.	Variety of crop.	Area. Kanals.	Area. Marlas.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Irrigations with dates. Toria sub-plots.	Irrigations with dates. Early Raya No. 3, sub-plots.	Remarks.
10 — 4	1a	Toria	0	19	1	38	8	16	21	1	Two waterings on— 9th October 1920 and 30th November 1920.	Two waterings on— 9th October 1920 and 28th December 1920.	Germination good, crop very good.
	1b	Early Raya No. 3 ...	0	19	2	17	6	20	20	0			
	2a	Ditto ...	0	19	3	0	0	25	10	8			
	2b	Toria	0	19	1	33	8	15	18	15			
	3a	Do.	0	19	1	32	8	15	10	8			
	3b	Early Raya No. 3 ...	0	19	2	34	0	24	0	0			
	4a	Ditto ...	0	19	2	20	4	21	2	1			
	4b	Toria	0	19	1	30	0	14	29	7			
		Average outturn per acre. Toria	3	16	7	14	8	15	20	0		Average outturn per acre. Mds. Srs. Chs. 15 19 15¾	
		Early Raya No. 3 ...	3	16	10	31	10	22	28	2		22 28 2	

Statement No. XLVIII

SHOWING THE EFFECT OF HARROWING IMMEDIATELY AFTER SOWING AND NOT HARROWING WITH LOCAL TORIA ON TENANT'S LAND AT L. A. S., YEAR 1920-21.

No. of square and plot.	No. of sub-plot.	Area in acres.	Treatment.	Date of sowing.	Date of harvesting.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
18 — 9	1	49 — 160	No harrow immediately after sowing.	11th September 1920	12th January 1921.	2	33	0	9	8	15	Waterings three on— 22nd October 1920, 11th November 1920 and 26th November 1920. Germination good, germination better in harrowed plots.
	2		Bar harrow immediately after sowing.	Ditto	Ditto	2	32	0	9	5	11	
	3		No. Bar harrow immediately after sowing.	Ditto	Ditto	2	38	8	9	26	15	
	4		Bar harrow immediately after sowing.	Ditto	Ditto	2	27	8	8	31	0	
16 — 8	1	9 — 32	No Bar harrow immediately after sowing.	28th August 1920	24th December 1920.	1	7	4	4	8	0	Waterings two on— 18th October 1920 and 11th November 1920. Germination thin, stood poor, but germination was better in harrowed plots.
	2		Bar harrow immediately after sowing.	Ditto	Ditto	0	38	0	3	15	1	
	3		No Bar harrow immediately after sowing.	Ditto	Ditto	0	33	8	2	39	1	
	4		Bar harrow immediately after sowing.	Ditto	Ditto	1	10	0	4	17	12	
17 — 12	1	163 — 640	No Bar harrow immediately after sowing.	7th September 1920.	25th December 1920.	2	35	8	11	13	8	Waterings three on— 15th October 1920, 5th November 1920 and 26th November 1920. Germination good throughout. Stand of the crop also good.
	2		Bar harrow immediately after sowing.	Ditto	Ditto	2	17	0	9	20	13	
	3		No Bar harrow immediately after sowing.	Ditto	Ditto	2	22	0	10	0	7	
	4		Bar harrow immediately after sowing.	Ditto	Ditto	2	37	0	11	19	6	
			Average yield per acre.									Average yield per acre. Mds. Srs. Chs.
1	1	Area in acres. 539 — 320	No Bar harrow	...		13	9	12	7	34	8	7 36 2
	2	539 — 320	Harrowing immediately after sowing.	...		13	1	8	7	29	9	7 31 10

Statement No. XLIX

SHOWING THE COMPARATIVE RESULTS OF GRAMS (E. B.'S 17 AND LOCAL) GROWN IN THE TENANTS' AREA DURING RABI 1920-21.

No. of squre and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chataks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chataks.	Number of irrigation with dates.	Date of sowing.	Remarks.
16 / 23	1	E. B.'s No. 17 ...	1	2	1	35	0	13	25	7	Two waterings on— 20th January 1921 and 6th March 1921.	14th October 1920.	Germination good. Crop fairly good.
	2	Local	1	2	2	2	8	15	0	0			
	3	E. B.'s No. 17 ...	1	2	2	4	4	15	12	11			
	4	Local	1	2	1	24	0	11	25	7			
	5	E. B.'s No 17 ...	1	2	1	37	0	14	0	0			
	6	Local	1	2	1	29	0	12	21	13			
	7	E. B.'s No. 17 ...	1	2	1	33	0	13	10	14			
	8	Local	1	2	1	35	4	13	27	4			

AVERAGE OUTTURN PER ACRE.

AVERAGE OUTTURN PER ACRE CALCULATED ON YIELD PER ACRE.

											Mds.	Srs.	Chs.
1	E. B.'s No. 17 ...	4	8	7	29	4	14	2	4		14	2	4
2	Local	4	8	7	10	12	13	8	10		13	8	10

Statement No. L

SHOWING THE COMPARATIVE RESULTS OF GRAMS (LOCAL AND E. B'.S No. 7), GROWN IN TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chataks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chataks.	Number of irrigations with dates.	Date of sowing.	Remarks.
5 / 10/2	1	E. B.'s No. 7 ...	1	2	3	7	0	23	3	10	One watering only on— 20th January 1921.	25th October 1920.	Germination and crop both good.
	2	Local ...	1	2	3	20	0	25	18	3			Ditto ditto.
	3	E. B.'s No. 7 ...	1	2	2	16	8	17	21	13			Germination thin in some places. Crop good.
	4	Local ...	1	2	1	28	8	12	18	3			Germination irregular on one side. Crop fairly good.
13 / 13	1	E. B.'s No. 7 ...	0	19½	1	14	8	11	12	15	Two waterings on— 19th January 1921 and 7th March 1921.	15th October 1920.	Germination good. Crop average.
	2	Local ...	0	19½	1	32	0	14	38	7			Ditto.
	3	E. B.'s No. 7 ...	0	19½	1	16	8	11	29	9			Ditto.
	4	Local ...	0	19½	1	31	0	14	30	2			Ditto.
	5	E. B.'s No. 7 ...	0	19½	1	13	8	11	4	10			Ditto.
	6	Local ...	0	19½	1	25	8	13	24	6			Ditto.
	7	E. B.'s No. 7 ...	0	19½	1	9	0	10	7	4			Ditto.
	8	Local ...	0	19½	1	0	0	8	12	7			Level on one side higher hence germination thinner on that side. Crop average.

AVERAGE OUTTURN PER ACRE.

AVERAGE OUTTURN PER ACRE CALCULATED ON YIELD PER ACRE.

Mds. Srs. Chs.

Statement No. LI

SHOWING THE COMPARATIVE RESULTS OF GRAMS (E. B.'S No. 15 AND LOCAL) GROWN IN THE TENANTS' AREA DURING RABI, 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chataks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chataks.	Number of irrigations with dates.	Date of sowing.	Remarks.
7/17	1	E. B.'s No. 15	2	3	5	3	8	18	37	3	Two on 20th January 1921 and 9th March 1921.	5th October 1920 ...	Germination good. Crop good.
	2	Local ...	2	3	3	25	8	13	21	6	Ditto ditto.	Ditto ...	Germination good except the middle portion which was rather unlevel.
	3	E. B.'s No. 15	2	3	5	13	8	19	34	6	Ditto ditto.	Ditto ...	Germination good. Crop good.
	4	Local ...	2	3	5	4	0	18	39	1	Ditto ditto.	Ditto ...	Ditto.
		Average yield per acre.									Average outturn per acre calculated on yield per acre.		
	1	E. B.'s No. 15	4	6	10	17	0	19	15	13		Mds. Srs. Chts. 19 15 13	
	2	Local ...	4	6	8	29	8	16	10	3		16 10 3	

Statement No. LII

SHOWING THE COMPARATIVE RESULTS OF GRAMS (E. B.'S No. 20 AND LOCAL) GROWN IN THE TENANTS' AREA DURING RABI 1920-21.

No. of square and plot.	No. of sub-plot.	Name of variety.	Area. Kanals.	Area. Marlas.	Actual outturn of grain. Maunds.	Actual outturn of grain. Seers.	Actual outturn of grain. Chataks.	Outturn of grain per acre. Maunds.	Outturn of grain per acre. Seers.	Outturn of grain per acre. Chataks.	Number of irrigations with date.	Date of sowing.	Remarks.
	1	E. B.'s No. 20	0	19½	1	17	8	11	31	12	Two on 19th January 1921 and 7th March 1921.	13th October 1920...	Germination good. Condition of the crop average.
	2	Local ...	0	19½	1	5	0	9	9	3	Ditto ditto.	Ditto ...	Ditto ditto.
13	3	E. B.'s No. 20	0	19½	1	16	8	11	23	9	Ditto ditto	Ditto ...	Ditto ditto.
15	4	Local ...	0	19½	1	14	0	11	3	1	Ditto ditto.	Ditto ...	Ditto ditto.
	5	E. B.'s No. 20	0	19½	1	33	0	14	38	15	Ditto ditto.	Ditto ...	Ditto ditto.
	6	Local ...	0	19½	1	26	8	13	25	10	Ditto ditto.	Ditto ...	Ditto ditto.
	7	E. B.'s No. 20	0	19½	1	20	0	12	12	4	Ditto ditto.	Ditto ...	Ditto ditto.
	8	Local ...	0	19½	1	16	0	11	19	7	Ditto ditto.	Ditto ...	Ditto ditto.
		Average outturn per acre.									Average outturn per acre.		
	1	E. B.'s No. 20	3	18	6	7	0	12	26	10		Mds. Srs. Chts. 12 26 10	
	2	Local ...	3	18	5	21	8	11	14½	5		11 14 5	

Statement No. LIII

SHOWING THE COMPARATIVE RESULTS OF GRAMS (E. B's. No. 15 *VERSUS* LOCAL) IN SQUARE 26.

No. of square and plot.	No. of sub-plot.	Area in acres.	Varieties.	Actual outturn. *Grain.* Maunds.	Seers.	Chataks.	*Straw.* Maunds.	Seers.	Chataks.	Outturn of grain per acre. Maunds.	Seers.	Chataks.	Number of irrigations with dates.	Date of sowing.	Previous Kharif crop.	Remarks.
26 / A IV-2	1	⅛	No. 15 ...	0	20	0	0	18	8	4	0	0	One—16th January 1921.	9th October 1920.	Chari, Guara	Ploughings— Rajah plough 1; Desi plough ... 1; Sohagaings ... 3; Harrowings ... 2
	2	⅛	Local ...	1	4	12	1	1	0	8	38	0				
	3	⅛	No. 15 ...	0	26	12	0	23	8	5	14	0				
	4	⅛	Local ...	0	25	12	0	23	8	5	6	0				
	5	⅛	No. 15 ...	0	32	2	0	24	8	6	22	0				
	6	⅛	Local ...	0	27	4	0	21	0	5	18	0				
	7	⅛	No. 15	1	17	0	1	5	8	11	16	0				
	8	⅛	Local ...	2	12	8	2	7	0	18	20	0				

Average outturn per acre—

	Mds.	Srs.	Chts.
No. 15 ...	6	33	0
Local ...	9	26	8

Statement No. LIV

SHOWING THE COMPARATIVE YIELDS IF MANGEL-WARZELS (SRINAGAR *VERSUS* SUTTON) SOWN IN RIDGES IN ALTERNATE ROWS IN SQUARE 26-D—DURING RABI 1920-21.

No. of square.	No. of plot.	Treatment.	Area in marlas.	Variety.	Actual outturn. *Roots.* Maunds.	Seers.	*Leaves.* Maunds.	Seers.	Outturn per acre. *Roots.* Maunds.	Seers.	Chataks.	*Leaves.* Maunds.	Seers.	Chataks.	Number of irrigations.	Date of harvest.	Remarks.
26 / D	1	Heavy dressing of Farmyard manure.	8·25	Srinagar...	12	9	1	2	237	3	10	20	14	9	6	26th—27th April 1921.	With 6 waterings the increase of fodder in case of Sutton over that of Srinagar = Mds. Srs. Ch. 87 18 15. While with 9 waterings = Mds. Srs. Chs. 56 25 1. But Sutton seed costs Rs. 3 per acre more than Srinagar one therefore the increase of fodder in each case more than repays the high cost of seed.
				Sutton ...	20	3	1	21¼	389	13	5	29	27	14	6	28th—29th April 1921.	
	2			Srinagar...	15	38	1	32	309	13	5	34	36	6	9	1st May 1921	...
				Sutton ...	21	5	1	30	409	27	14	33	37	9	9	30th April 1921	...
	3			Srinagar...	10	15	1	19	201	8	8	28	24	4	6	3rd May 1921	...
				Sutton ...	14	1	1	4	272	0	0	21	13	5	6	2nd May 1921	...
	4			Srinagar ..	11	10	1	23	218	7	4	30	21	13	9	5th May 1921	...
				Sutton ...	15	4	1	10	292	33	15	24	9	11	9	4th May 1921	...
	5			Srinagar...	10	26	1	38	206	21	13	37	32	11	6	7th May 1921	...
				Sutton ...	13	19	1	2	261	13	5	20	14	9	6	6th May 1921	...
	6			Srinagar...	10	31	1	19	208	38	12	28	24	4	9	9th May 1921	...
				Sutton ...	10	33	1	9	209	37	9	23	30	5	9	8th May 1921	...

Average yield per acre with 6 waterings				*Roots.* Mds.	Srs.	Chts.	*Leaves.* Mds.	Srs.	Chts.
Srinagar	...	...		214	38	0	28	37	3
Ditto 9 ditto Sutton	...	...		307	22	3	23	31	15
Ditto 9 ditto Srinagar	...	...		245	19	12	31	14	2
Ditto 9 ditto Sutton	...	...		304	6	7	37	12	8

Annual report of Gurdaspur Agricultural Station for the year ending 30th June 1921.

Introductory.—I have held charge of the farm throughout the year under report. M. Mukhtar Nabi was the manager of the Station till 14th June 1921 when he proceeded on leave and was relieved by Abdul Ghani Khan. M. Mukhtar Nabi was therefore responsible for the actual management of the farm and the experimental work carried thereon.

History.—History in brief has already been given in previous reports. The primary object of the farm when started in 1910 was to serve as a sugarcane breeding institution for the Province. It has since been gradually developed into wheat experimental farm as well as a centre for various other agricultural problems fully bearing in mind its chief aim. It is now one of the most important farms of the Punjab where besides some important agricultural experiments, the teaching work has also been inaugurated.

Area.—The total area of the farm now consists of 161 acres, which, as stated last year, is hardly adequate to meet the extended requirements of the experimental and research work coming within the scope of the station. The actual cultivated area has further undergone a decrease owing to the allotment of area for construction of the sarai, the new implement shed and the plots reserved for the school for teaching purposes.

Extension of the chahi area for sugarcane cultivation is an urgent and pressing matter as the present area is by no means sufficient to enable us to tackle the foremost problems immediately connected with this crop. This becomes all the more important when it is remembered that the station is to be looked upon as the central sugarcane breeding institution for the Province. The extension of thick canes and trials on field scale of some of the imported Coimbatore varieties along with the enhanced requirements for fodder due to addition of live stock further press the immediate necessity of extension. The ambition of the station is to keep pace with the general development of world agriculture and scientific and mechanical innovations abroad and to test efficiency, for this part of the empire, of labour saving machinery, particularly the new tractors, which are likely to gain a strong hold in Indian agriculture. The farm is divided into 4 main blocks (2 chahi and 2 barani) and each block has been sub-divided into suitable experimental plots, the numbering of which has been fixed in such a way as to create no difficulty in reading experimental results thereon. Plots are mostly in duplicate sets in order to facilitate rotations, and are of sufficiently large size to avoid the common experimental defects due to their limited size.

To quote a prominent expert visitor to the farm "*it has been laid out to yield reliable results in future.*"

Season and its effect on the crops.— (Statement I). The rainfall during the year under report was 20·41″ against 30·94″ of the previous year and 34·5″ as average of the district. Though the figures for the year are by no means disappointing yet this is considered as one of the worst agricultural years ever experienced. The proper distribution of rainfall is equally important to the total quantity, and irregularity in either case, generally speaking, brings a sure disaster. Best results accrue only from timely and even distribution which has not been the case this year. With about 15″ during July and August the sowing of kharif became well nigh impossible, though some attempts were made to bury seed in marsh like fields. With another shower of 3·41″ in September the kharif crop had no opportunity to make any growth, and consequently failed *in toto*. The cane which had, become established and advanced sufficiently benefited from rains, though it could not totally ward off their deleterious effects, as would appear from the figures given in statement 2-F. Excess of water delays maturity of cane, which results in nipping by early frosts and decrease in outturn of gur.

The welcomed rain in September enabled us to tackle the barani area and the sowing of the rabi was easily carried out in well prepared and moist seed beds. Good germination ensued everywhere on the farm, but followed by a long spell of drought during practically the whole life-time of the rabi, the young wheats, and consequently the whole crop, were badly reduced in outturn. The 0·49″ in January and 0·94″ (in three showers of 0·52″, 0·24″ and 0·18″) in February were insufficient to revive the dying crop or to instil any spirit of hopefulness. With unprecedented adverse conditions during winter the months of March and April put a finishing touch to the wheats when the temperature went up in leaps and bounds and suddenly the hot weather was at its height.

This hastened premature ripening, but the heavy and dry hot wind storm caught the young grains and reduced their size considerably.

The harvest started in the fourth week of March which is a fortnight earlier than in normal years, and was the poorest we have had for some years past. Despite all what has been said we were able to show outturn figures about three times those obtained in the district. The highest chahi figures of 3,035 lbs per acre from Cross 3 (inspite of the tube well calamity mentioned hereafter) is quite satisfactory while the highest barani outturn of 861·6 lbs per acre in the case of 8-A is a wonderful success in the year when it is remembered that there was practically no barani crop (except that in bets) left in the district.

Frost was of no consideration this year.

Crop Pests.—"Cane borer" was very bad on the barani cane crop and even the chahi fields did not altogether escape it. The "Mealy wings" bug also appeared in the irrigated cane but did not do any appreciable amount of damage. As would be expected in a year like this rust had no place anywhere. But a couple of new wheat varieties imported from Bombay Presidency were attacked by "Black Rust" and for fear lest this new disease should transmit its infection to other varieties the crop, in entirety, was destroyed and burnt. Smut however, appeared whole-sale on the farm. Careful rouging out of the smutted ears was done, but steeping the seed in Copper Sulphate Solution seems indispensable for the next few years in order to stamp out this pestilent fungus. The need for steeping is all the more emphasized as smut has been noticed on sugarcane and has caused a good deal of alarm.

Crop. — Kharif.

Sugarcane.—(Statements 2 to 2-F.)

Sugarcane varietal tests.—(Statement 2 to 2-A.)

As is wont sugarcane follows Senji in the common rotation maize, senji, sugarcane wheat adopted on the farm. The senji was removed fairly early, *i.e.*, in January, in order to enable adequate preparatory tillage before cane was planted. This year besides the chahi area some varieties were tried barani in order to see to what extent and which of them could grow successfully in districts of fairly good rainfall. It is recognized that where evaporation and transpiration of moisture through the leaves of plants are limiting factors to success the crop selected must be deep rooted and with as narrow leaf blades as possible; with these points in view Katha, Dhaulu and 2 Coimbatore varieties, Co 202 and Co 205, were grown side by side. These canes along with all other varieties sown in the chahi area made excellent progress till the end of June, but the rains in July and August caused some anxiety for chahi canes growing in rather low lying fields and were responsible for a little belated ripening. The barani varieties which had become the prey of "Cane Borer" cast all fears aside with the break of the monsoon, which afterwards helped to sustain the crop during the long and continuous period of drought. The chahi cane had to be given two waterings after the monsoon instead of one, which is as a rule enough to bring the crop to maturity in normal years.

Chahi.—Following varieties were grown on chahi area (statement 2) Behar, Yuba Katha, Dhaulu, Co 205, Suretha, Java 105, Java 36. Highest outturn of 4,952 lbs. of gur per acre has been given by Behar in its test of 9th January 1921, when it was somewhat riper than at the time when the previous crushing was done. In the case of Behar where two readings were taken, one in December and the second in January, the latter shows a definite increase in gur per acre (statement 2). This points to the importance of harvesting cane at the time when it has attained full maturity, and that the general practice of judging the time for harvest is liable for an enormous amount of loss. The average of the two crushing of Behar put its outturn at 4,846 lbs. per acre, and even then it maintains the top. This represents the highest figure obtained at the farm since its inception Co 205 with 4,436 lbs. per acre stands second.

This variety was imported from Madras, where it was obtained by crossing the Sachrum Spontanium (ordinary Sarkanda) with one of the thick canes of Madras. It has been grown here since 1918, in order to allow it to acclimatize and to propagate seed (sets) for extensive sowings. This was the first year when it was brought in the regular varietal test on field scale, and it has so far stood its test exceedingly well.

The third on the list is Yuba, with 4,330 lbs. per acre as highest, and an average 4,101 lbs. per acre from two crushings. Dhaulu stands fourth with 3,048 lbs. per acre immediatela followed by Java 36 with 2,952 lbs. per acre; Suretha with 2,902 lbs. per acre; Kathy with average of 2,783 lbs. per acre. In one of the crushings however Katha has given a much as 3,036·5 lbs. per acre.

Java 105 has been the worst of all this year as unfortunately its seed got over-heated during burial. The germination was, very meagre and therefore does not deserve to be discarded at present. For the next year the seed (sets) have been obtained from selected plants. Of all above varieties Behar, Yuba, J105 and J36 are true medium canes while Katha and Dhaulu are, strictly speaking, thin varieties. Suretha and Co 205 however though coming under the same category are somewhat of intermediate types. Highest outturn has been given by Behar while the second is Co 205. Yuba which is number 3 is not badly off. Java 105 should be treated as an exceptional case and J 36 has only for the first time been brought into tests on field scale.

Coimbatore 205 has yielded encouraging results this year and it is very likely that it may become a very close rival to Behar. Therefore, in order to get practical corroboration of the results at Gurdaspur it has this year been arranged to try environment experiments with these varieties in different localities. So a set of Behar, a medium cane Co 205; an intermediate

cane and Katha or Dhaulu as local thin varieties have been arranged at :—

Sargodha, Lyallpur, Hansi } Canal Colonies.

Sardarpur—Inundation canal, Shahpur District.

Sialkot, Beas, Jullundur } Well irrigated.

Looking at the outturn figures and judging from the past years' results it appears that the medium canes like Behar and Yuba have always given best outturns at the farm. Next to these will be an intermediate variety, while none of the thin canes compare favourably with either the medium or intermediate types.

One would naturally infer that the medium and the intermediate are therefore the best types to be adopted in the district, but it remains to establish which variety will be the best suited. However no stress is laid on this inference and trial for several more years must be done before anything definite can be deduced.

Barani—(Statement 2-A) Katha, Dhaulu, Co 205 and Co 202 were tried in a barani field, as recommended by the Sugarcane Expert, Madras. Co 205 has stood first in such a bad year with a very encouraging figure of 2,196 lbs. of gur per acre though zemindars could grow no purely barani cane except under inundation and on low-lying places. Katha with 1,868 stood second. Co 202 with 1,562 and Dhaulu with 1,376 have not done badly. Co 205 displayed a very unusual demonstration of putting up "arrows" in both barani as well as chahi, but unfortunately the flowers were sterile, and no distinction of male and female sexes was discernable. Being a cross with Sacchorum Sponteneum, the flowering indicates its pedigree and, if ever the flowers become fertile, crossing with some improved and acclimatized canes as Behar may be possible.

Coimbatore varieties.—They deserve some exploration. In Madras the cane is found to arrow very freely and the flowers are fertile.

This had enabled the Government Sugarcane Expert at Coimbatore to produce, by crossing, some new and hardy varieties. Sixteen such varieties were imported into the Punjab in 1918 and tested at Gurdaspur on small areas. Out of these only 5 have so far given encouraging result and have now been brought up in the regular scheme of comparative test along with other varieties. Co 205 and 202, as has already been mentioned, are being tried on barani along with Katha and Dhaulu. Co 216 and 223 on account of being deep rooted have recently been brought on the barani area and will be tested along with the others. Co 204 has so far been grown only on the chahi area and is not a promising variety. For marks alloted to each variety according to their various merits see my last year's report.

Ridges versus flat cultivation of Sugarcane.—(Statement 2-B) Katha, Dhaulu and Behar were grown both on ridges and on the flat in order to see which would yield more. Falt in all cases seems to have given better results but, as it is the first year of the trial and owing to some experimental errors, no comments are offered. The experiment will be repeated.

Spacing experiment with cane.—(Statement 2-C) Dhaulu and Behar were given spaces of 1, 2 and 3 feet from row to row. In case of both it seems waste to give them a space of 3 feet. One foot has given highest outturn with Behar and the 2 feet with Dhaulu. The experiment will be repeated.

Crushing and Boiling tests with Sugarcane.—(Statement 2-D, 2-E).—Crushing and boiling are of as much importance as is the production of good juice producing varieties of cane in the development of the sugar industry of the world. Much depends on getting the maximum percentage of juice in the shortest possible time and at the same time in effecting its boiling most economically. For this a large number of bullock and power crushers are found in the market and various methods of boiling are adopted. In order to test efficiency of a few of such machinery crushing experiments were started with :—

(1) Desi two rollered (Batala).
(2) „ three „ „
(3) The Nahan.
(4) Chattanooga (bullock power).
(5) „ (Engine power).
(6) The Hathi (Elephant).
(7) The Desi wooden Belna.

The Engine power Chattanooga crusher gave juice percentage of 62 last year and it is capable of crushing 10 mauuds of cane per hour. A brief description of its working along

with that of the Poona Furnace was given in the last years's report but owing to want of roofing, etc., the test could not be carried out this year.

The results obtained from other crushers this year do not tally with those of the last year's, as there is a decrease in the percentage of juice in each case. It may be due to experimental errors as well as rough surface of the rollers having weathered with age. Nahan is at present considered the best crusher in the market and is suitable for both thick and thin canes but it stands second in order of merit which is as follows: —

I Chattanooga (bullock power) = 54·8% average of 3 bits.
II Nahan ... ... = 53·6% „ „ 4 „
III Desi 3 rollered ... ... = 52·9% „ „ 4 „
IV Desi 2-rollered-45.2% average of 3 bits.
V Desi Belna ... ... = 43·9% average of 4 bits

Careful experiments, recording the time taken to crush a definite amount of cane (one variety for all) and the draft on bullocks will next year be carried out along with percentages of juice obtained.

As regards boiling, the Poona furnace for reasons stated above could not be worked. Two new furnaces were prepared—one a copy of Hadi's method and the other an improvement effected in the Desi "Choola" (furnace) by the adoption of the Poona furnace principle. The former could not be worked this year but figures obtained with two boilings in the latter are shown in statement 2-E. In each boiling there is a marked saving of fuel. The results will be confirmed next year and if successful no doubt it will easily find its way to the zemindars.

Analytical results of sugarcane.—(Statement 2-F) Sugarcane grown in this part of the Province is subject to fatal result from early frost, and one of the aims of this station is to produce a very early ripening variety which can be harvested and crushed before frost sets in. Moreover it is of the utmost importance that to obtain maximum outturns the cane must be quite ripe before harvest but as has already been pointed out the ordinary eye-system of judging whether a particular variety is ripe or not often leads to a great deal of loss. Therefore it becomes necessary to find out if any changes occur in the percentage of juice and its various sugars before and after the advent of frost and during its ripening period in December and January. Therefore this year chemical analysis of almost all varieties were carried out at three different times, *e. g.*, before frost, during frost, and after frost during November, December and January. However, though owing to the absence of frost this year the results obtained are considered inconclusive, one fact becomes apparent, that the highest sucrose contents are found in cane when it is dead ripe, it is low in immature or over ripe cane. The maturity of cane not only bears on sucrose contents, but it also effects the outturn of gur per acre.

This brings the necessity of harvesting cane at the right time to the front in order to avoid such errors chemical analysis and Brix readings have been decided on.

2. *Maize.*—This year again no varietal tests could be carried out on account of unsuitable weather at sowing time.

Maize is a difficult crop to experiment with as it crosses very easily and the crosses are apparent even in the very first generation. A large area is required to grow different varieties at fair distances and careful selection has each time to be resorted to. This has thoroughly been done for the next year's crop.

3. *Cottons.*—Economic Botanists environment experiments with cottons continue. The Desi varieties like Rosea and Mollisoni appear to be better off than the American 4-F. Some seed of a new variety 285-F has also been grown for the next year.

4. *Miscellaneous.*—Groundnuts, Australian Bajra, til, Mash and some chari varieties were grown on the farm, but owing to unfavourable weather none gave any satisfactory results. The seed for the next year has been obtained and regular trials with chari varieties collected from several Punjab districts and Australian Bajra *versus* the local type have been started. The flat *versus* the ridge method of sowing groundnuts will also be taken up, but varietal trials with this crop have for the present been postponed.

RABI.

5. *Wheat.*—It may be stated at the outset that the season was extremely unfavourable for the rabi from beginning to end. It rained only 18·33″ during the preparatory period of July to September against 23-84″ of the last year, but moisture was well preserved both in barani and chahi fields and the sowing operations were satisfactory. The barani area was aken up and the first sowing was done on the permanent wheat and wheat and gram plots n 16th October 1920 and the whole area completed on 2nd November 1920.

In the chahi area also there was plenty of moisture preserved by good tilth, it was decided to sow two fields, one barani and the other after rowny (irrigation before sowing), though both had sufficient moisture for the purpose. Field A/3 was therefore sown without irrigation, and the results obtained therefrom (statement 3) compare very favourably with those on field A/4 which received irrigation before sowing. Both fields received two waterings after sowing. The average outturn in A/4 was given by 8-A at 1,910 lbs. per acre and

in A/3 at 1,915 lbs. per acre; thus 5 lbs. per acre in favour of the latter field. Both crops throughout were equally good and one could with great difficulty express opinion in favour of one or the other. It clearly shows that where water is deficient thorough cultivation can lighten the burden and the common agricultural proverb that "Cultivation is irrigation" is again confirmed.

The rest of the chahi sowings were done after irrigation and the germination all over the farm on both barani as well as chahi was uniform. But ill luck followed in October to December being absolutely dry and the tube-well pump failed at the critical time when irrigation was most needed. During January and February it rained 1·43" inch and that in four small showers, so that their beneficial results were vitiated by their insignificance. Besides the continued spell of drought and the failure of the tube well the temperatures rose very high during March and April and hastened the already struggling crops to complete their course as fast as possible. This was again interrupted by hot windstorms which caused a great deal of shrivelling of grain. Another and extremely heavy windstorm, after the crop had been reaped, blew the bundles several hundred yards from their proper fields, and besides an arduous and careful work of separation of varieties, caused enormous waste by shedding grains from unthreshed ears.

The tube well failure was a very serious blow to the irrigated wheat. In spring when vigorous growth starts afresh the demand for irrigation is the greatest and any mishaps at such a critical time will never enable the crop to recover its lost ground. This is exactly what happened here, and though in normal times this years chahi crop, inspite of adverse circumstances, would have excelled all past records, yet the yields are quite satisfactory.

Though such a bad year has not been witnessed before yet the average outturn of the whole of the barani comes to 480·4 lbs per acre against 1,358 lbs. of the last year and 246 lbs. per acre of the district. The highest outturn on the barani is 861·6 lbs. per acre this year at the farm.

Average outturn of the whole of the chahi is 1,714 lbs. per acre against 761 lbs. of the average of the district. The highest outturn of the chahi is 3,035 lbs. per acre this year at the farm and this, when read along with the fact that timely irrrigation was not possible in such a bad year, is a very satisfactory outturn.

The following experiments have been carried out with wheat this year :—

(1) Comparative varietal tests in chahi area.
(2) „ „ „ „ barani area.
(3) Cultivation experiments in the barani area
(4) Manurial experiments with chahi and barahi wheats.
(5) Emergency wheats

1.—*Comparative varietal tests in chahi area.*

The following varieties were tested :—

Fields A-3 and A-4- 8-A, 8,8 Pusa 12 Pusa 4 (in A-4 only), Punjab 11, Punjab 17, Punjab 17-B, G-1, G-2, G-3, cross 3, Punjab 16 A (8-A as standard).

Field A-14 Cross 3, Punjab 1 3, G-1, G-2, G-3, NH48 × P4, NH 80 × P4, NH165 × P4, Cawnpore 13, Pusa 4, A. O-89 and 16A

Field A-2A, 8A, Pusa 12 and Punjab 11, with 8-A as standard.

Field D-2, 8-A, 8-B, G-1 and G-2.

For outturn figures see statements 3-3C. Results vary in all the five fields. 8A has stood first in two cases (in fields A-2A and D-2) with 998 lbs. per acre as average of 5 bits and 3rd in one case (Field A-3) with 1,91 , lbs. per acre as average of 21 bits and 4th in the other (A-4) with 1,910 lbs. per acre as everage of 23 bits.

The following are the five of the more important types of the year with the average. yields from their average of all fields in chahi area :—

Varieties.	lbs. *per acre.*		
Cross No. 3	2,309	Average of	5 *Plots.*
Pusa 4	2,001	„ „	2 „
Punjab 11	1,649	„ „	6 „
Pusa 12	1,618	„ „	6 „
8-A	1,608	„ „	49 „

Pusa 4 and Punjab 11 had been discarded from the farm but were reintroduced this year. Their good results show that it is advantageous to change seed as old seed deteriorate in any one place.

Punjab 17-B and G-3 seem useless for all practical purposes as chahi wheats. Punjab 13 has never before been grown in the chahi area and, though it lodged badly, it has done very well in A-14 with 2,668 lbs per acre.

16-A is a new wheat grown for the first time at this farm, it was supplied by the Economic Botanist, Lyallpur. The average outturn of 1,860 lbs. per acre from 5 plots is encouraging considering the first year of its trial was under such an unfavourable climate.

Last year 8-A gave 1,850 lbs per acre as its highest yield inspite of lodging, and 1,681 lbs. per acre as an average of 15 plots. This year it has yielded 2,223 lbs. as its highest and 1,608 lbs. per acre as an average of 49 plots. No. other wheat has been grown on any thing like as many plots as 8-A and therefore cannot well be compared in general with it, when it is realized that smaller areas always show high returns, and that the smaller the areas of plots, the greater will the experimental error be.

It may, therefore, be safely assumed that 8 A still holds its position and is at present the premier wheat of the Punjab.

Howards wheats—(statement 3-A):—G-1, G-2, G-3, NH × 48-P-4, NH × 80-P4, NH 165 × P-4 are Mr Howards crosses and have been grown at this farm for sometime. "G" representing "Gurdaspur" has for the sake of brevity been adopted in the first 3 but the others are comparatively new and the names with which they came from Pusa have for the present been continued. G-3 has always been the last and might well be discarded. G-1 and G-2 seem to be doing well, and their trials on a field scale will be continued. But at present little is known of the others. The following are the yields of the last three from field A-1 :—

NH 48 × P4	...	2,778 lbs. per acre
NH 80 × P4	...	2,636 „ „ „
NH 165 × P4	...	2,586 „ „ „

Comparative varietal tests of Barani wheats.—(statements 4, 4-A, 4-B).

The following varieties have been tried.

8-A
8-B
17-B
16-A
Cross 3
} Mr. Milne's selections.

Punjab 13 and 14 local wheats.

Pusa 12, Mr. Howard's wheats, and some others imported from Bombay and the Central Provinces.

Reliable results are not available as owing to severe windstorm (to which reference has already been made) the bundles of different varieties got dispersed and mixed. As would appear from the weather conditions which the crop has undergone the beardless wheats (and especially the early ripening Pusa 12), have been, on the whole much better off this year. They to a large extent escaped the shrivelling due to hot winds and owing to their early habits have accorded with this year's high temperature and matured their grains before much shrivelling could be caused.

In one of the tests (Statement 4-A) Pusa 12 and 8-A were tested with Punjab 14 as standard. The field allotted had just produced a heavy crop of chari, but owing to September shower some moisture was preserved and the crop sown, hence the comparatively low outturn : but as expected Pusa 12 with 675 lbs. per acre, as average of two plots, stands first, followed by 8-A with 630·5 lbs. and Punjab 14 with 5,103 lbs.

In field C-5 (statement 4) several varieties were tested with Punjab 14 as standard and stand in the following order :—

I Pusa 12	...	560·7 lbs per acre
II 17-B average	...	427·5 „ „ „
III 8-B	...	423 „ „ „
IV 8-A	...	382·5 „ „ „
VI 16-A	...	293·5 „ „ „
V Punjab 14	...	358· „ „ „
VII Punjab 13	...	212 „ „ „
VIII Cross 3	...	170·5 „ „ „

The tests were duplicated in Block C and as expected pusa 12 tops the list. This year 8-A, being rather a late ripener, was badly reduced by shrivelling. The results as a whole should be considered unreliable for this year, and no definite inference should be drawn.

Emergency wheats. (Statements 5 and 4-B.)—

As the season is often uncertain in the central and other barani districts of the Punjab it has been found that the area under wheat is decreased if monsoon is unfavourable and particularly if September rains fail. But in order to counteract the effects of such unpropitions seasons some attempts are made to sow wheat and barley as late as December or January on the advent of late Christmas rains. Such late sown crops are handicapped owing to reduction in the time allowed them to grow, and, hence always give very poor outturns. If we could discover some short-lived and early ripening varieties of wheats, which, if sown in December or even January with the Christmas rains, could still mature at the ordinary time and give a fair outturn, one of the greatest problems of Indian dry-farming will then be solved.

Pusa 12 is the earliest ripening variety we have in the Punjab, but unfortunately, if sown as late as December or January, it makes comparatively little headway and the yield is poor. Thus, advised by Mr. Milligan, the Agricultural Adviser to Government of India, some new varieties, said to be very early ripeners in Bombay and Central Provinces and likely to maintain the same habit in the Punjab, were imported and grown at the farm. If any one of them is found successful it may be called an emergency wheat, and will be stored by the Department in large quantities for distribution amongst zemindars for late sowings in December or January, if the sowing rains of September fail. But if the season is favourable, and normal sowings are possible, the stock of such wheats can be disposed of in the market.

Thus four varieties—A.O. 89, Pusa 4 } from Central Provinces

Katha Dohad, Red Athni } from Bombay

and some seed of Pusa 4 from Pusa were imported. This being the first year it was considered advisable not to give these newly imported varieties too severe conditions and therefore sowing was done in two lots, both early and late in chahi area as well as barani. (Statement 5).

Sowings were arranged as follows :—

Chahi, on 2nd November 1920 } early.
14th November 1920 }

1st December 1920 } late.
17th January 1921 }

Barani.—1st November 1920 ... early.

17th November 1920. late.

The season was abnormally bad and the newly imported varieties had a hard struggle for existence. The failure of the tube well prevented timely irrigation to the chahi plots, yet it was possible to get some seed and the trial is therefore hopeful.

Bombay varieties were such a hopeless mixture that it was impossible to recognise the genuine types. Moreover they were both badly infested with black rust and lest infection of this unknown fungus in the Punjab should spread (for then the harm will be more than the good even if these varieties become a success) both were destroyed and burnt.

A.O 89 and Pusa 4 promise well, and their trials will be continued.

Cultivation Experiments with barani wheats.—(Statement 6, 6-A, 6-B, 6-C.).

The experiments of the last year were continued and consisted of the following :—

(*a*) Harrowing *versus* no harrowing.
(*b*) Sabul plough *versus* desi plough.
(*c*) Rajah plough *versus* desi plough.
(*d*) Permanent wheat plot,
(*e*) permanent wheat and gram plot.

(*a*) Conservation of moisture is the key to success in barani cultivation, and harrowing is done with the object of breaking the crust which may be produced on the surface after rain, and also to create a mulch which will prevent loss of moisture by evaporation. It would be expected that, harrowed plots would in a dry year give better outturns than unharrowed plots ; but judging from last year's results in which the " unharrowed " gave an increase of 94 lbs. over the " harrowed " and again this years, *i.e.*,

	Yield
" No harrow "	759·6 lbs. per acre,
" Harrow "	609· 6 lbs. per acre,

that is, an increase of 150 lbs. in favour of the unharrowed, the results do not bear out the hpyothesis.

On investigation of the cause it was suspected that owing to somewhat hard surface in the second 9 " of soil from the surface a pan may be in existence. Ordinary digging done with the spade seemed to confirm the suspicion, but the moisture analyses of the soil (statement 15 attached) does not bear it out. The damage may have been done in a critical year like this when owing to thorough tillage there was a fair depth of loose soil and young seedlings were only lightly attached to the ground below. With no adjustable arrangement in the bar harrow the slightest touch (which in normal year on irrigated land does no harm) pulled the entire plant out, thus effecting the final outturn.

After rains in January and February the condition of the unharrowed portion looked improved, but, after harrowing the plots designed for this progress seemed slow. It appears that whatever rain we got we could not conserve as the depth of harrowing with this harrow could not be kept less than half an inch, but the showers were small and hardly penetrated the soil to that extent. Thus stirring this portion must have caused complete eveporation of this moisture, to the detriment of the crop.

This emphatically bears out my belief that the bar harrow, inspite of admitted usefulness in canal irrigated tracts is unsuitable for barani areas. The ordinary lever harrow though very expensive, excels the bar harrow in every respect in dry farming.

(*b*) *Sabul* versus *Desi plough*.—The results obtained in this test are also marvellous and contrary to all expectations. The average yield of 3 plots under sabul and desi ploughs have given 522 lbs. and 601 lbs. respectively. With an increase of 79 lbs. in case of the latter. This is the first year when such results have been obtained last year the sabul increased outturn by 154 lbs. over that of the desi. Nothing beyond the suspicion of the existence of plough pan can solve this mystery at present, but regular trials of rajah, sabul and the desi ploughs have been inaugurated on another field which will be carried out over a sufficient number of years to reveal all facts. As a precaution subsoiling with a deep ploughing with the sabul plough, in absence of a proper subsoiler, has been carried out in all suspected plots.

(*c*) *Rajah* versus *desi plough*.—(Statement 6-B.)—Here again the desi plough has given 72 lbs. more than the rajah plough, in view of what has been stated above it deserves not comment.

(*d*) *Permanent wheat and wheat and gram plots*.—(Statement 6-C.) Permanent wheat plot has given 375 lbs. while the wheat and gram plots gave 504 lbs. per acre. They are less than half of the outturns of the last year, but this is in no way surprising for this particular year. Complete list of results since the inception of experiment has been supplied in the statement. It is to be continued for a number of years before conclusive results can be drawn.

6. *Manurial Experiments*.—So far artificial as well as organic manures have been tried on wheat and sugarcane mainly in the chahi area in barani only with wheat. The results obtained, though in reality bearing out the general experience of the use of artificial manures (that the application of such manures gives an increased yield but that the increase is insufficient to cover the cost of the manure) are somewhat variable and quite inconclusive. On chahi area two manurial experiments have been in progress. The first was designed to test the effect of Phosphates in the presence of green manure on wheat and the second to test the value of various manures directly on sugarcane. In the case of the former owing to insufficiency of control plots and adoption or two different wheats instead of one the results cannot be looked upon with confidence. In the case of the latter the results show that manures containing ammonium sulphate give a decided reaction on sugarcane. No reaction is found in the case of wheat.

On barani area the results are also doubtful and the experiment had become rather stale and very complicated with very little chance to lead to any success. The whole manurial scheme for the farm both on chahi and barani has been redesigned in consultation with the Agricultural Chemist and the work started on fresh and simple lines, testing effects of simple manures to start with and as experience is gained will develop into more complex chemical problems.

Although the old lines of experiments have been dispensed with and fresh scheme worked out, the following few trials deserve mention :—

Manurial experiment with wheat.—(Statements 7---11.)

Green manuring experiment with Bhung (*Indian Hemp*)—(Statement 7.)

All the last years experiments were repeated with the inauguration of a new4-year test on barani wheat by the addition of green manure. The value of organic matter in soil is well recognised and previous experiments have always shown good results from this on irrigated lands. It yet remains to ascertain to what extent green manuring can be useful in

barani areas. So far green manuring has strictly been correlated with leguminous crops only, but it is hinted that the beneficial effects of such manures do not accrue only from the common properties of the leguminous crops but that a great deal is due to some other factors as well. Therefore Bhung which is easily obtainable in this district was carted to the farm in August and buried in 3 lots on the sandiest portion of the farm land. The test was arranged in duplicate with six control plots. The manurial plots received 24, 48 and 72 maunds of Bhung. As the idea of the experiment originated rather late the Bhung could not be buried earlier than August, but a shower in September helped to decay the buried crop. The results are favourable in case of all treated plots amounting to 251 lbs. per acre with control and 500 lbs. per acre in the case of manure. It was noticed from the very start that the growth in Bhung plots was directly proportional to the amonnt of matter buried while the control had no comparison whatever.

Next year the same experiments will be carried out in the adjoining plots of the same field, and the old plots tested for residual effects.

Artificial Manurial Experiments with wheats.

Barani.—(*a*) (Statement 8).—To see the results of bonemeal residue and by direct application of superphosphate at 1½ cwt. per acre. The test was triplicated.

The results are as follows :—

	Grain.		*Bhusa.*	
Bonemeal residue ...	571·2 lbs.	per acre	1153·3 lbs.	per acre.
Superphosphate ...	486·0 lbs.	„ „	927·0 lbs.	„ „

From 3 strips in the case of bonemeal residue there is a loss of about Rs. 9 per acre, inspite of greater outturn, but the gain in case of superphosphate of Re. 0-7-6 per acre is only nominal.

(*b*) (*Statement* 9).—There is a loss in each case. Results of (NH-4) SO-4 alone or in conjunction with phosphatic manures show a decided loss and, though there is an increase in almost all manured plots, it is not compatible with the cost of the manure used. Therefore the scope of such manures seems very limited unless they can be cheaply manufactured in India.

(*c*) (*Statement* 10).—Shows results of ammon ium sulphate and superphosphate alone and in conjunction with each other on Punjab 13 and 8-A wheats.

The idea of this experiment was to see if the manures could help to bring the crop to early maturity. Both types of wheat are very good barani wheat, but are rather late ripeners and are almost always caught by hot winds and grains get shrivelled. Unfortunately the experiment was carried out in such a bad year that nothing definite can he deduced.

Chahi.—(*Statement* 11).—Residual effects of bonemeal and superphosphate in conjunction with green manuring show profit this time only, except in two plots where there is a loss. But as the experiment was arranged in a complicated manner by putting in two varieties of wheats and two fertilizers it is unsafe to consider "Phosphates" as paying when used with green manures.

Artificial Manurial Experiments with sugarcane.—(Statement 12).—This experiment was conducted only in chahi area with Dhaulu. Organic bulky manures like castor cake and farmyard manure (also town sweepings) were compared with $N_2 No_3$ (Sodium Nitrate). Owing to lodging of the crop and certain othere errors the results are not reliable.

As stated above all these various old experiments have been redesigned into a fresh manurial scheme, and the work on chemical manures may now be considered to have started on sound lines at this farm.

1. Varietal experiment with gram.—(Statement 13).—Economic Botanist Nos. 17 and 20 have given the highest outturn of 1430 lbs. per acre. Of these No. 17 stood first even last year.

Others in order of merit are :—

Local

No. 15 Small Kabuli, and

No. 7, Large Kabuli.

8. Other Rabi crops on the farm were oats (local and the French) sarson, potatoes, mangel wurzel and many winter vegetables, grown to supply fodder and to serve for teaching and demonstration.

9. *Poultry.*—Demand for pure and other eggs and chickens continues as before, but we have been very unfortunate with our stock owing to large mortality amongst the birds.

There were the same four breeds.—
White Orpingtons,
Buff Orpingtons,
Rhode Island Reds,
and the Black Leghorns,
with Aylesbury Ducks.

The site for the runs is too limited and the housing arrangements are defective, but as there is no separate allotment of funds to encourage this side of husbandry no improvements in the existing arrangement can be effected and therefore it is intended to reduce the number of breeds to one or two and dispose of the rest as best as possible.

10. *Miscellaneous.*—(*a*) With a lot of trouble to the farm staff, damage to Rabi crops and delay in the next year's sugarcane sowing, a new pump has been installed to work the tube well. The pump is capable of giving a discharge of one cusec of water, but since the completion of the installation of the pump the discharge has decreased from ·95 cusecs to ·72 cusecs at which it now seems stationery. The defect seems not in the pump so much as in the strainer of the well which may have been silted up. Though it is an improvement over the last discharge it is by no means sufficient or economical.

(*b*) The second power-crusher has not yet been received though orders for purchase were placed with the firms long ago. The Poona-furnace trials have therefore again been postponed partly for this and partly for want of roofing arrangements entrusted to the Agricultural Engineer. I am informed that the matter is in hand.

(*c*) Some preparation of refined sugar with the hand centrifugals was done for demonstration but unless all the three machines are turned into power centrifugals and attached to the engine little work can be possible.

This is also being done by the Agricultural Engineer.

(*d*) The need for more seed and manure godowns has been keenly felt on the farm. Extension of buildings with erection of a new implement shed is in hand.

(*e*) The old custom on the farm to mix up all wheats from the chahi and barani areas and the sowings done with the mixed seed is no doubt objectionable. This was not only unfair in varietal tests but led to a good deal of decreased outturn as chahi wheats growing on barani and *vice versa* failed to give their maximum returns. Arrangements have been made to store barani and chahi crops separately and to do the barani sowings only from the crop raised on barani areas.

(4) With four new bullocks puchased for the vernaculur class the total number is 35. They are all doing well.

11. *Sarai.*—The *Sarai* has been completed and taken over. It has removed all inconveniences the visitors were put to when they came in parties to the farm. Accomodation is also now available for the vernacular classes which were started during the year. The lecture room has been furnished with tables and benches and is sufficient to accommodate a class of about 36 students. Arrangements to supply other articles for the lecture room are being made.

The interior of the *Sarai* has been turned into a grass lawn.

12. *Visitors.*—The farm has and is still gaining a widespread popularity and is much frequented for purchase of seed, implements. It has become a favourite spot for the education parties of Inspectors and Sub-Inspectors of the Co-operative Societies. Mr. S. Milligan Agricultural Adviser to Government of India, and the Hon'ble Mr Harkishan Lal were amongst our distinguished visitors of the year.

13. *Staff.*—M. Mukhtar Nabi has been in charge of the farm throughout the year except the last fortnight when he proceeded on leave and was relieved by Abdul Ghani Khan. M. Mukhtar Nabi's experience with sugarcane and specially his knowledge of Dry farming befits him for the post. Lala Lekh Ram amongst the other farm Assistants worked well and I am glad to record the whole hearted co-operation and dutiful spirit of all the farm staff.

14. *Acknowledgments.*—Thanks are due to Mr. H. Harcourt, Deputy Commissioner, Gurdaspur, for his interest in the welfare of the farm.

The 31st July 1921.

M. SULTAN ALI,
Dy. Director of Agriculture,
1st Circle, Gurdaspur.

Statement No. 1.

Rainfall Record at Gurdaspur Agricultural Station for the year 1919-20 and 1920-21.

Serial No.	Rain fall during the year 1919-20		Year 1920-21	
	Months.	Rainfall.	Rainfall.	Remarks.
		Inches.	Inches.	
1	July	14·44	8·42	
2	August	8·74	6·59	
3	September	0·66	3·41	
4	October	...	...	
5	November	0·25	...	
6	December	1·69	...	
7	January	0·89	0·49	
8	February	1·48	0·94	
9	March	0·84	...	
10	April	0·11	...	
11	May	0·68	0·65	
12	June	1·16	0·56	
	Total	30·94	20·97	

Statement No. 2 (Chahi Cane).

COMPARATIVE TEST OF SUGARCANE VARIETIES IN CHAHI AREA DURING KHARIF 1920-21.

Field No.	Plot No.	Area in square yards.	Varieties.	Actual outturn in lbs. of			Calculated outturn per acre in lbs.			Percentage of juice to canes.	Percentage of gur to juice.	Percentage of gur to canes.	Date of crushing.	Remarks.
				Canes.	Juice.	Gur.	Canes.	Juice.	Gur.					
A 5	1	605	Behar ...	5,842·5	4,055	592·5	46,740	32,440	4,740	69·4	14·6	10·1	12th December 1920.	Preparation :— Raja plough ... 1 Country ploughs ... 5 Harrowings ... 6 Sohagas ... 10 Date of sowing :— 29th March 1920. Dates of irrigation :— (1) on 1st May 1920. (2) on 26th May 1920. (3) on 13th June 1920. (4) on 12th July 1920. (5) on 2nd October 1920 (6) on 23rd October 1920. Interculture :— Hoeings ... 5 With Baguris 2 With Khurpa 2 With Spade 1
	2	302·5	Do ...	2,685 5	1,763	309·5	42,968	28,208	4,952	65·7	17·5	11·5	9th January 1921.	
	3	302·5	Yuba ...	2,439·5	1,435	243	39,032	22,960	3,872	58.8	6·8	9·9	4th January 1921.	
	4	302·5	Do. ...	2.972·5	1,763	270·6	47,560	28,208	4,330	59·3	15·4	9·1	5th January 1921.	
	5	605	Co. 205 ...	5,043	3.403	554·5	40,344	27,224	4,436	67·5	16·2	11·0	31st December 1920.	
	6	605	Suretha ..	3,659·2	2,091	362·8	29,274	16,728	2,902	57·1	17·3	9 9	4th January 1921.	
	7	288	Dhaulu ..	1,988·5	1,066	181·4	60,418	17,909	3,048	53·6	16·9	9·1	30th December 1920.	
	8	756½	Katha ...	4,048·5	2,214	399·7	25,910	14,170	2,558	54·7	18·1	9·9	14th December 1920.	
	9	462	Do. ...	2,921·2	1,640	287	30,603	17,181	3,006·5	56·1	17·5	9·8	29th December 1920.	
	10	302·5	Do. ...	2,019·2	...	174·2	32,307	...	2,787	...	...	8·6	9th January 1921.	
	11	302·5	Java 36 ...	2,101·25	1 189	184·5	33,620	19,024	2,952	56·6	15·5	8·7	10th January 1921.	
	12	346	Java 105 ...	1,138	738	112·8	15,913	10,323	1,578	64·8	15·3	9·9	31st December 1920.	

Statement No. 2-A (Barani Area).

COMPARATIVE TEST OF CANE VARIETIES IN THE BARANI AREA.

No. of Field.	Name of variety.	Area harvested in square yards.	Weight of cane in lbs.	Weight of juice in lbs.	Weight of gur in lbs.	Weight of cane per acre in lbs.	Weight of juice per acre in lbs.	Weight of gur per acre in lbs.	Percentage of juice to cane.	Percentage of gur to cane.	Percentage of gur to juice.	Remarks.
B 4	Katha ...	1,210	4,817·5	2,531·7	407	19,270	10,127	1,628	52·55	8·45	16·07	Date of sowing :— 20th March 1920. Date of crushing :— 4th, 6th December 1920. Cultivation :— Raja ploughs ... 2 Desi plough ... 12 Harrowings ... 20 Sohagas ... 45 (Out of 45 Sohagas 30 Sohagas given between 28th February and 19th March 1920. Desi plough was followed by Sohaga three to four times always.) After cultivation :— Lever harrowings ... 3 Hoeings ... 3
	Dhaulu ...	1,210	4,622·7	1,906·5	344	18,490·8	7,626	1,376	41·25	7·44	18·05	
	Katha ...	1,210	5,863	2,593	467	23,452	10,372	1,868	44·23	7·97	18·01	
	Co. 202 ...	1,210	5,135	2,460	390·5	20,540	9,840	1,562	47·90	7·60	15·88	
	Katha ...	1,210	4,684	1,927	344	18,736	7,708	1,376	41·13	7·34	17·85	
	Co. 205 ...	1,210	7,410·7	2,706	549	29,642·8	10,824	2,196	36·51	7·40	20·29	

Statement No. 2-B.

SHOWING THE RESULTS OF SUGAR-CANE SOWN ON FLAT *VERSUS* RIDGES DURING 1920-21 IN CHAHI AREA.

Block Field.	Area in square yards.	Variety.	Treatment.	Actual outturn in lbs. of			Outturn per acre in lbs. of			Percentage of juice to canes.	Percentage of gur to juice.	Percentage of gur to canes.	Date of crushing.	Remarks.
				Canes.	Juice.	Gur.	Canes.	Juice.	Gur					
A 7	1,018	Katha	Sown on ridges	4,802	2,900·5	461	22,830	13,790	2,191	60·39	15·9	9·6	17th December 1920.	Cultivation— Rajah plough ... 1 Desi plough ... 6 Harrowing ... 3 Sohaga ... 8 Date of sowing 25th March 1921. Irrigation on flat 5 Irrigation on ridges 11
	1,044	Do.	Sown on flat	5,996	3,772	658	27,798	17,487	3,050·5	62·91	17·45	10·97	28th December 1920.	
	302·5	Dhaulu	Sown on ridges	1,773·2	861	119	28,371	13,776	1,904	48·56	13·82	6·71	4th January 1921.	
	302·5	Do.	Sown on flat...	2,244·8	1,127·5	186·5	35,917	18,040	2,984	50·2	16·55	8·3	4th January 1921.	
	302·5	Behar	Sown on ridges	1,619·5	820	137·4	25,912	3,120	2,198	50·65	16·76	8·48	12th January 1921.	
	302·5	Do.	Sown on flat...	2,511	1,558	283	40,176	24,928	4,528	62·03	18·17	11·27	12th January 1921.	

Statement No. 2-C.

SHOWING THE RESULT OF SPACING EXPERIMENT WITH SUGAR-CANE DURING THE YEAR 1920-21 IN THE CHAHI AREA.

Block Field.	Area in square yards.	Variety.	Space between the furrows.	Actual outturn in lbs. of			Outturn per acre in lbs.			Percentage of juice to canes.	Percentage of gur to juice.	Percentage of gur to canes.	Date of crushing.	Remarks.
				Canes.	Juice.	Gur.	Canes.	Juice.	Gur.					
A 9	560	Dhaulu	One foot ...	2,655	1,394	207	22,946	12,048	1,789	52·52	14·85	7·77	31st December 1920.	Cultivation— Rajah plough ... 1 Desi plough ... 5 Harrowing ... 2 Sohaga ... 2 Date of sowing 21st March 1920. Waterings on— (1) 29th April 1920. (2) 4th May 1920. (3) 9th June 1920. (4) 12th July 1920. (5) 5th October 1920.
	302·5	Do.	Two feet ...	1,691·3	758·5	118·9	27,061	12,136	1,902	44·85	15·68	7·709	7th January 1921.	
	302·5	Do.	Three feet ...	1,424·8	615	98·4	22,727	9,840	1,574	43·16	16·0	6·91	7th January 1921.	
	302·5	Behar	One foot ...	2,040	1,025	170·2	32,640	16,400	2,723	50·24	16·57	8·33	8th January 1921.	
	302·5	Do.	Two feet ...	1,742·5	922·5	139·4	27,880	14,760	2,230	52·95	15·1	8·0	8th January 1921.	
	302·5	Do.	Three feet ...	1,630	861	133·2	26,080	13,776	1,231	52·82	15·5	8·17	8th January 1921.	

Statement No. 2-D.

COMPARATIVE TESTS OF DIFFERENT CANE-CRUSHERS, DURING 1920-21.

Serial No.	Name of crusher.	Variety of cane.	Weight of canes.	Time taken in crushing.	Juice.	Gur.	Per cent. of juice to canes.	Crushing rate of canes per hour.	Remarks.	
			Mds. Srs. Ch.	H. M.	Mds. Srs. Ch.	Mds. Srs. Ch.		Mds. Srs. Ch.		
I (*i*)	Nahan	Katha ...	1 31 0	0 30	1 0 0	...	56·3	3 22 0		54·5
(*ii*)	Do.	Do. ...	4 14 0	1 45	2 18 0	0 15 0	52·8	2 19 0		
II	Chatancoga... ...	Do. ...	3 35 0	2 10	2 10 0	...	58·0	1 29 0		58·0
III (*i*)	Batala 3 rollered ...	Do.	2 14 0	0 45	1 12 0	0 8 0	55·3	3 5 0		55·4
(*ii*)	Ditto ...	Do. ...	3 31 0	1 15	2 4 0	0 14 8	55·6	3 0 0		
IV (*i*)	Batala 2 rollered ...	Do. ...	2 19 0	1 15	1 6 0	0 7 8	46·4	1 39 0		46·0
(*ii*)	Ditto ...	Do. ...	2 36 0	1 15	1 13 0	0 9 0	45·7	2 13 0		
V (*i*)	Wooden belna ...	Do. ...	3 5 0	1 32	1 19 0	0 11 0	47·2	1 3 0		47·5
(*ii*)	Ditto ...	Do. ...	4 0 0	2 15	1 36 8	0 15 12	47·8	1 31 0		
I (*i*)	Nahan	Dhaulu ...	4 32 0	1 35	2 24 8	0 20 0	54·4	2 37 0		52·8
(*ii*)	Do.	Do. ...	5 25 0	...	2 35 8	0 20 8	51·3	...		
II (*i*)	Chatanooga... ...	Do. ...	3 32 0	1 10	2 1 0	0 14 0	53·3	2 30 0		51·7
(*ii*)	Ditto	Do. ...	5 29 0	...	2 35 0	0 20 0	50·2	...		
III (*i*)	Batala 3 rollered ...	Do ...	3 16 0	1 0	1 29 0	0 12 0	50·8	2 31 0		50·4
(*ii*)	Ditto ...	Do. ...	6 2 0	2 11	3 1 0	0 19 0	50·0	...		
IV	Batala 2 rollered ...	Do. ...	3 5 0	1 15	1 15 8	0 7 0	44·4	2 20 0		44·4
V (*i*)	Wooden belna ...	Do. ...	4 4 0	2 1	1 20 0	0 10 0	36·5	2 0 0		40·3
(*ii*)	Ditto ...	Do. ...	3 20 0	1 40	1 22 0	0 12 8	44·2	...		

Statement No. 2-E.

COMPARATIVE TESTS OF IMPROVED AND DESI FURNACES.

Serial No.	Improved double pan furnace.						Desi single pan furnace.						Remarks.
	Yield.		Gur.		Fuel for 100 maunds of Gur.		Yield.		Gur.		Fuel for 100 maunds of Gur.		
	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	Mds.	Srs.	
1	12	14	3	11	393	5	10	36	2	20	436	0	Two tests in case of improved furnace show lot of difference which is due to the furnace being new in the first test.
2	6	12	2	31	172	39	6	20	2	3	313	10	
Average ...	9	13	3	1	283	2	8	28	2	11½	374	25	

Statement No. 2-F.

SHOWING THE ANALYSIS OF CANE VARIETIES GROWN AT GURDASPUR FARM (COIMBATORE AND FARM).

Name of cane.	Date of analysis.	Juice per cent.	Glucose per cent.	Sucrose per cent.	Total Sugar.	Total solids (Brix).	Glucose ratio.	Purity co-efficient.	Remarks.
			I.—Barani.						
Katha ...	26th November 1920	50·38	0·49	17·40	17·90	19·93	1·79	87·28	
Do. ...	Ditto ...	53·74	0·62	17·38	18·0	20·16	3·57	86·21	
Do. ...	14th December 1920	52·32	0·70	15·92	16·62	18·85	4·4	84·46	
Dhaulu ...	26th November 1920	51·11	0·59	15·47	16·06	17·43	3 88	88·82	
Do. ...	16th December 1920	55·80	0·74	17·37	18·11	19·93	4·26	87·16	
Co. 205 ...	27th November 1920	57·10	1·52	12·64	14·16	16 01	12·02	78·96	
Do. ...	14th December 1920	53·91	2·33	13·61	15·94	17·0	17·12	83·06	
Co. 202 ...	26th November 1920	56·43	1·28	13·07	14·35	16·22	9·79	80·58	
Do. ...	16th December 1920	Spoiled.	1·34	13·73	15·07	17·26	9·80	79·55	
			II.—Chahi Canes.						
Katha ...	14th December 1920	54·11	0·89	17·12	18·01	20·56	5·26	88·75	
Do. ...	27th January 1921	62·22	1·15	16·92	18·07	20·78	7·0	81·33	
Do. ...	28th February 1921	63·11	0·28	18·71	18·99	22·3	1·5	83·90	
Yuba ...	15th December 1920	67·75	2·02	15·16	17·18	18·83	13·8	80·51	
Do. ...	27th January 1921	72·19	0·92	17·07	17·99	19·88	5·4	80·83	
Suretha ..	15th December 1920	63·59	1·19	15·76	16·95	19 93	7 64	79·08	
Do. ...	28th January 1921	63·37	0·45	16·17	16·62	20 15	2·3	80·25	
Do. ...	27th February 1921	56·10	1·07	17·37	18·44	21·78	6·16	79·90	
J. 36 ..	15th December 1920	69·66	1·06	16·34	17·40	19·03	6·51	85·86	
Java 36 ...	28th January 1921	72·97	0·36	17·92	18·28	20.5	2·01	87·41	
Do. ...	27th February 1921	66·71	0·42	17·55	17·97	20·06	2·4	87·48	
Dhaulu ...	15th December 1920	58·34	0 41	17·44	17·85	20·74	2·34	84·9	
Do. ...	27th January 1921	59·51	0·41	18·16	18·57	20·88	2·26	87·00	
Do. ...	28th February 1921	56·26	0·70	17·95	8·65	21·50	4·0	83·48	
Behar ...	18th December 1920	70·69	2·39	13·06	15·45	16·81	18·3	77·70	
Do. ...	27th January 1921	71·99	1·40	16·11	17·51	19·08	8·70	84·44	
Java 105 ...	18th December 1920	70·00	1·32	15·35	16·67	18·52	8·6	82·89	
U. P. IIS ...	Ditto ...	72·26	1·32	15·01	16·33	17·40	8·81	86·26	
Do.	28th Februray 1921	69·74	0·65	16·91	17·56	19·0	3·80	89·0	

Statement No. 2-F—CONCLUDED.

SHOWING THE ANALYSIS OF CANE VARIETIES GROWN AT GURDASPUR FARM (COIMBATORE FARM)—CONCLD.

Name of cane.	Date of analysis.	Juice per cent.	Glucose per cent.	Sucrose per cent.	Total Sugar.	Total solids (Brix).	Glucose ratio.	Purity co-efficicent.	REMARKS
			II.—CHAHI CANES—*concldcd.*						
Khadiya ...	18th December 1920	69·08	1·32	12·65	13·97	16·08	10·5	78·73	
Red Mauritius ...	19th December 1920	71·83	2·11	11·65	13·76	15·39	18·14	75·7	
Green Spart ...	Ditto	71·99	1·58	16·62	18·19	19·26	9·50	86·3	
Stripped Mauritius	Ditto	71·94	1·53	15·91	17·44	17·91	9·64	88·87	
			COIMBATORE CANE (CHAHI).						
Co. 205 ...	14th December 1920	61·38	2·50	13·75	16·25	18·04	18 18	76·22	
Do. ...	25th January 1921	65·91	1·17	12·40	13·57	16·42	9·5	75·22	
Do. ...	26th February 1921	57·71	1·59	13·25	14·85	16·76	12·0	77·70	
Co. 204 ...	16th December 1920	66·13	2·85	11·38	14·23	16·72	25·07	68·07	
Do. ...	25th January 1921	66·99	0·81	12·23	13·03	15·75	6·6	77·70	
Do. ...	27th February 1921	60·74	1·28	11·88	13·16	15·7	10·8	75·67	
Co. 202 ...	16th December 1920.	55·12	1·38	14·42	15·80	17·82	9·6	80·92	
Do. ...	25th January 1921	59·10	0·45	16·46	16·92	17·98	2·76	91·55	
Do. ...	27th February 1921	56·40	0·37	16·24	16·61	18·6	2·27	87·31	
Co. 206 ...	17th December 1920.	66·13	2·73	12·23	14·98	17·0	22·35	71·90	
Do. ...	26th January 1921	64·43	1·16	13·22	14·32	17·09	8·77	77·76	
Do. ...	27th February 1921	61·94	1·09	14·80	15 89	18·06	7·40	82·0	
Co. 216 ...	17th December 1920.	63·43	2·22	13·48	15·70	17·0	16·64	89·39	
Do. ..	26th January 1921	64·45	1·37	11·45	12·82	15·92	12·0	71·99	
Do. ...	26th February 1921	61·13	0·83	14·21	15·08	17·0	6·12	80·0	
Co. 221 ...	19th December 1920.	70·68	1·35	16·49	17·84	18·76	8·18	87·37	
Do. ...	26th January 1921	69·11	0·55	17 25	17·80	19·50	3·18	88·5	
Do. ...	26th February 1921	65·99	0·43	18·32	18·75	20·82	2·35	88·0	
Co. 222 ...	17th December 1920.	63·22	2·30	11·98	14·28	17·25	19·18	68·47	
Do. ...	26th January 1921	58·87	0·98	13·69	14·67	17·2	7·20	79·60	
Do. ...	26th February 1921	56·50	1·16	13·79	14·85	19·0	8·41	76·61	
Co. 223 ...	16th December 1920.	63·71	1·32	15·09	16·41	18·52	8·73	82·31	
Do. ...	26th January 1921	64·79	0·78	16·73	17·51	19·51	4·70	85·75	
Do. ...	26th February 1921	65·45	0·63	17·78	18·41	20·6	3·54	86·31	

Statement No. 3.

COMPARATIVE TEST OF WHEAT IN CHAHI AREA.

Block and field No.	Area in square yards.	Variety.	Date of sowings.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
					Grain.	Straw.	Grain.	Straw.	
		8-A ...	1st November 1920 ...	19th April 1921 ...	190·6	285	1,708	2,525	
		8-B ...	Ditto ...	Ditto ...	231·6	418	2,075	3,747	
		8-A ...	Ditto ...	Ditto ...	248	328	2,223	2,940	
		Pusa 12 ...	Ditto ...	7th April 1921 ..	244	387	2,187	3,369	
		8-A ..	Ditto ...	19th April 1921 ...	184	361	1,649	3,236	
		Punjab 11 ...	Ditto .	Ditto ...	254	398	2,276·5	3,567	
		8-A ...	Ditto ...	Ditto ...	225·5	510	2,021·5	4,571	
		Punjab 17 ...	Ditto ...	10th April 1921 ...	192·7	404	1,727	3,621	
		8-A ...	Ditto ...	19th April 1921	238	445	2,133	3,988	
		17-B ..	Ditto ...	7th April 1921 ...	162	450	1,452	4,033	
		8-A ...	Ditto ...	19th April 1921 ...	211	423	1,891	3,818	
		G_1 ...	Ditto ..	7th April 1921 ...	176·3	520	1,580	4,661	
		8-A ...	Ditto ...	19th April 1921 ...	194	330	1,739	2,958	
		G_2 ...	Ditto ...	7th April 1921 ...	166	390	1,488	3,496	
		8-A ...	Ditto ...	19th April 1921 ...	219	390	1,963	3,496	
		G_3 ..	Ditto ...	Ditto ...	133	380	1,192	3,406	
		8-A ...	Ditto ...	20th April 1921 ...	227·5	367	2,039·5	3,289	
		16-A ...	Ditto ...	Ditto ...	207	338	1,855	3,080	
		8-A ...	Ditto ...	Ditto ...	207	360	1,855	3,227	
		Cross 3 ...	Ditto ...	Ditto ...	196·8	328	1,764	2,940	
A / 8	540	8-A ...	Ditto ...	Ditto ...	201	418	1,801·5	3,747	Cultivation—
		8-B ...	Ditto ...	Ditto	164	381	1,470	3,415	Raja ploughs ... 2
		8-A ...	Ditto ..	Ditto ..	213	357	1,909	3,200	Country ploughs ... 5
		Pusa 12 ...	Ditto ...	7th April 1921 ..	178·4	379	1,598·5	3,397	Hartowings ... 6
		8-A ...	Ditto	20th April 1921 ...	203	367	1,820	3,289	Sohagas ... 9
		Punjab 11 ...	Ditto ...	Ditto ...	201	416	1,801·5	3,729	Wheat-harrowing... 1
		8-A ...	Ditto ..	Ditto ...	194	379	1,739	3,397	Waterings—
		Punjab 17 ...	Ditto ..	10th April 1921 ...	164	336	1,470	3,012	(1) 22nd December 1920.
		8-A ...	Ditto ...	20th April 1921 ...	221	334	1,981	2,994	(2) 23rd March 1921.
		17-B ...	Ditto ...	12th April 1921 ...	139·4	383	1,250	3,433	According to the yields the varieties stand as follows—
		8.A ...	Ditto .	Ditto .	217	383	1,945	3,433	*Variety.* *Yield.* lbs.
		G_1 ...	Ditto ...	7th April 1921 ...	164	432	1,470	3,872	(1) Pb. 11 2,039
		8-A ...	Ditto ...	20th April 1921 ...	222	412	1,990	3,693	(2) Cross 3 1,984·5
		G_2 ...	Ditto ...	7th April 1921 ...	170	328	1,524	2,940	(3) 8 A 1,915
		8-A ...	Ditto ...	20th April 1921 ...	227·5	456	2,039	4,087	(4) Pusa 12 1,893
		G_3 ...	Ditto ...	Ditto ...	115	340	1,030	3,047	
		8-A ...	Ditto ...	Ditto ...	213	440	1,909	3,944	
		16-A	Ditto ...	Ditto ...	201	522	1,801·5	4,679	
		8-A ...	Ditto ...	Ditto ...	217	438	1,945	3,926	
		Cross 3 ...	Ditto ...	Ditto ...	246	450	2,205	4,033	
		8-A ...	Ditto ...	Ditto ...	215	420	1,927	3,764	

Statement No. 3— CONCLUDED.

COMPARATIVE TEST OF WHEAT IN THE CHAHI AREA.

Block Field.	Plot No.	Area in square yards.	Variety.	Date of sowing.	Date of harvesting.	Actual outturn in lbs. Grain.	Actual outturn in lbs. Straw.	Outturn per acre in lbs. Grain.	Outturn per acre in lbs. Straw.	Remarks.
	1	376	8 A	14th November 1920...	24th April 1921 ..	133	272	1,712	3,501	
	2	376	8-B ...	Ditto ...	Ditto ...	145·5	314	1,449	3,127	
	3	376	8-A ...	Ditto ...	Ditto ...	203	387	2,021	3,854	
	4	486	Pusa 12 ...	Ditto ..	6th April 1921 ...	203	418	2,021	4,163	
	5	486	8-A ...	Ditto ...	24th April 1921 ..	215	346	2,141	3,446	
	6	486	Punjab 11 ...	Ditto ...	Ditto ...	201	320	2,002	3,187	
	7	486	8-A ...	Ditto ...	Ditto ...	220·4	459	2,195	4,571	
	8	486	Puujab 17 ...	Ditto ...	11th April 1921 ...	178·3	301	1,775	2,998	
	9	486	8-A ...	Ditto ...	24th April 1921 ..	203	346	2,021	3,446	
	10	486	17-B ...	Ditto ...	11th April 1921 ..	151·7	314	1 511	3,127	
	11	486	8-A ...	Ditto ...	24th April 1921 ...	197	435	1,962	4,332	
	12	486	G_1 ...	Ditto ...	7th April 1921 ...	164	432	1,633	4,302	
	13	486	8-A ..	Ditto ...	24th April 1921 ..	215	390	2,141	3,884	
	14	486	G_2 ...	Ditto ...	7th April 1921 .	160	496	1,593	4,939	
	15	486	8 A ...	Ditto ...	24th April 1921 ...	203	398	2,021	3,963	
	16	486	G_3 ...	Ditto ...	20th April 1921 ...	104·5	394	1,041	3,924	
	17	486	8-A ...	Ditto ...	24th April 1921 ...	182·4	396	1,816	3,944	
	18	486	16-A ...	Ditto ...	Ditto ...	188·6	451	1,878	4 491	
	19	486	8-A ...	Ditto ...	Ditto ...	170	520	1,693	5,178	
	20	486	Cross 3 ...	Ditto ...	Ditto ...	205·2	478	2,043	4,760	
A 4	21	486	8-A ...	Ditto ...	Ditto ...	174	480	1,733	4,780	
	22	486	Pusa 4 ...	Ditto ...	7th April 1921 ...	207	475	2,061	4,730	
	23	486	8-A ...	Ditto ...	24th April 1921 ...	197	371	1,969	3,695	
	24	436	8 B ...	Ditto ...	Ditto ...	131	414	1,305	4,423	
	25	416	8 A ...	Ditto ...	Ditto ...	131	490	1,522	5,701	
	26	416	Pusa 12 ...	Ditto ...	6th April 1921 ...	194·7	502	2,266	5,839	
	27	486	8-A ...	Ditto ...	24th April 1921 ...	170	510	1,693	5,079	
	28	486	Punjab 11 ...	Ditto ...	Ditto ...	199	428	1,982	4,262	
	29	486	8-A ...	Ditto ...	Ditto ...	178·4	396	1,776	3,944	
	30	486	Punjab 17 ...	Ditto ...	11th April 1921 ...	164	381	1,633	3,794	
	31	488	8-A ...	Ditto ...	24th April 1921 ...	201	473	2,002	4,710	
	32	486	17-B ...	Ditto ...	11th April 1921 ...	139·4	307	1,388	3,057	
	33	486	8-A ...	Ditto ..	24th April 1921 ...	213	465	2,121	4,631	
	34	486	G_1 ...	Ditto ...	7th April 1921 ...	180·4	457	1·797	4,551	
	35	486	8-A ...	Ditto ...	24th April 1921 ...	203	410	2,021	4,083	
	36	486	G_2 ...	Ditto ...	7th April 1921 ...	180·4	426	1,797	4,242	
	37	486	8-A ...	Ditto ...	24th April 1921 ...	209	354	2,081	3,525	
	38	486	G_3 ...	Ditto ...	20th April 1921 ...	102·5	363	1,021	3,615	
	39	486	8-A ...	Ditto ...	24th April 1921 ...	164	410	1,633	4,083	
	40	486	16-A ...	Ditto ...	Ditto ...	187·5	303	1,867	3.017	
	41	486	8-A ...	Ditto ...	Ditto ...	199	393	1,982	3,913	
	42	486	Cross 3 ...	Ditto ...	Ditto ...	178·4	352	1,776	3,505	
	43	486	8-A ...	Ditto ...	Ditto ...	191	426	1,902	4,242	
	44	486	Pusa 4 ...	Ditto ...	7th April 1921 ...	195	447	1,942	4,452	
	45	486	8-A ...	Ditto ...	24th April 1921 ...	168	358	1,673	3,565	

Cultivation—
Raja plough ... 2
Country plough ... 6
Harrowings ... 7
Sohagas ... 8
Wheat harrowing ... 1

*70 square yards deducted due to rat attack.

Waterings—

4th January 1921.

25th March 1921.

According to the average yield per acre the varieties stand as such :—

Variety.	*Yield per acre.* lbs.
(1) Pusa 12	2,143.
(2) Pusa 4	2,001
(3) Punjab 11	1,992
(4) 8-A.	1,910
(5) Cross 3	1,909

Statement No. 3-A.

SHOWING THE VARIETAL TEST OF WHEAT IN CHAHI AREA (1920-21).

No. of block and field.	No. of plot.	Area in square yards.	Variety.	Date of sowing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
						Grain.	Straw.	Grain.	Straw.	
A / 14	1	338	Cross 3 ...	2nd November 1921	12th April 1921 ...	212	450	3,035	6,572	Cultivation—
	2	397	Punjab 13 ...	Ditto ..	Ditto ...	214	600	2,608	7,314	Raja plough ... 1
	3	397	G_1 ...	Ditto ...	6th April 1921 ..	201	498	2,450	6,070	Country plough 5
	4	397	G_2 ...	D tto ...	Ditto ...	218·3	455	2,662	5,543	Harrowing ... 6
	5	397	G_3 ...	Ditto ...	12th April 1921 ...	207	504	2 523	6,144	Sohaga ... 8
	6	397	N. H. $_{45}$ × P_4 ...	Ditto ...	6th April 1921 ..	227·5	596	2,773	7,264	Wheat harrowing 1
	7	397	N. H. $_{30}$ × P. $_4$ ...	Ditto ...	Ditto ...	216·25	611	2.636	7,447	Waterings on—
	8	397	N. H. $_{105}$ × P_4 ...	Ditto ...	Ditto ...	212·2	578	2,586	7,046	(1) 5th December 1920.
	9	397	13 C. ...	Ditto ...	Ditto ...	223·5	600	2,725	7,314	(2) 19th March 1921.
	10	337/2	Pusa 4 (C. P.) ...	Ditto	Ditto ..	102·5	307·5	2,499	7,496	
	11	397/2	A. O. 89 (C, P.) ..	Ditto ...	Ditto ...	85	289	2,072	7,046	
	12	397	16-A. ...	Ditto ...	10th April 1921 ...	155·8	555	1,899	6,766	

Statement No. 3-B—Field No. $\frac{D}{2}$ Chahi Area.

SHOWING THE VARIETAL TEST OF DIFFERENT WHEAT TYPES IN CHAHI AREA DURING 1920-21.

Field No.	Variety.	Area harvested in square yards.	Date of sowing.	Date of harvesting.	Actual outturn in lbs		Outturn per acre in lbs.		Cultivation.	Remarks.
					Grain.	Straw.	Grain.	Straw.		
D / 2	8-A	2,705	3rd November 1920...	18th April 1921 ...	779	1,603	1,393	2,867	Raja ploughs ... 2	
									Country ploughs ... 5	
	8-B	1,803	Ditto ...	Ditto ...	498	1,148	1,337	3,082	Harrowing ... 5	
									Sohaga ... 6	
									Wheat harrowing ... 2	
	G-1	1,803	Ditto ...	12th April 1921 ...	438·7	1,240·25	1,178	3,329	Date of irrigation—	
									(1) 22nd December 1920.	
	G-2	1,803	Ditto ...	Ditto ...	451	1,074·2	1,211	2,884	(2) 23rd March 1921.	

Statement No. 3-C.

SHOWING THE COMPARATIVE TESTS OF WHEAT TYPES IN CHAHI AREA DURING RABI 1920-21.

Block Field.	Sub-plot.	Variety.	Area in square yards.	Date of sowing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
						Grain.	Straw.	Grain.	Straw.	
	1	8-A ...	800	5th November 1920.	16th April 1921	215	332	1,301	2,009	Wheat followed jowar (chari)— Raja plough ... 1
	2	Punjab 11 ...	800	Ditto	Ditto	180	276	1,089	1,670	Country plough ... 3 Harrow ... 2
	3	8-A ...	800	Ditto	Ditto	150	215	907·5	1,301	Sohaga ... 6
	4	Pusa 12 ...	800	Ditto	10th April 1921	151·5	333	916·5	2,033	Wheat Harrow ... 1
A 2-A	5	8-A ...	800	Ditto	16th April 1921	131	185	792·5	1,119	
	6	Punjab 11 ...	415	Ditto	Ditto	63·5	92	741	1,073	915 average.
	7	8-A ...	415	Ditto	Ditto	22	139	1,073	1,621	
	8	Pusa 12 ...	415	Ditto	10th April 1921	62	84	723	980	820 average.
	9	8-A ...	415	Ditto	16th April 1921	78	108	910	1,260	937·9 average.

Waterings on No. 1—25th December 1921.
No. 3—22nd March 1920.

Statement No. 4, Field No. $\frac{C}{5}$.

VARIETAL TESTS OF WHEAT IN THE BARANI AREA.

Block field.	Plot No.	Area in square yards.	Variety.	Date of sowing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
						Grain.	Straw.	Grain.	Straw.	
$\frac{C}{5}$	1	1,336	Punjab 14 ...	21st October 1920	8th April 1921 ...	149·6	453	542	1,642	
	2	1,336	8-A ...	Ditto	Ditto ...	147·6	420	535	1,522·5	
	3	1,336	Punjab 14 ...	Ditto	Ditto ..	178	373	645	1,352	
	4	1,336	8-B ...	Ditto	Ditto ...	172	365	623	1,323	
	5	1,336	Punjab 14 ...	Ditto	Ditto ...	205	432	743	1,566	
	6	1,336	Pusa 12 ...	Ditto	Ditto ...	160	289	579·5	1,048	
	7	1,336	Punjab 14 ...	Ditto	Ditto ...	170	420	616	1,522·5	
	8	1,336	17-B ...	Ditto	Ditto ...	121	287	438	1,040	
	9	1,336	Punjab 14 ...	Ditto	Ditto ...	80	268	290	971	
	10	1,336	16-A ...	Ditto	Ditto ...	96·4	287	349	1,040	
	11	1,336	Punjab 14 ...	Ditto	Ditto ...	53·3	84	192	304·5	
	12	1,335	Punjab 13 ...	Ditto	Ditto ...	86	201	312	728·6	
	13	1,336	Punjab 14 ...	Ditto	Ditto ...	90	221	333	801	
	14	1,336	Cross 8 ...	Ditto	Ditto ...	51	100	185	362·5	
	15	1,336	Punjab 14 ...	Ditto	Ditto ...	115	144	417	522	
	16	1,336	8-A ...	Ditto	11th April 1921...	63·5	121	230	439	Cultivation—
	17	1,336	Punjab 14 ...	Ditto	Ditto ...	72	148	261	536·5	Raja ploughs ... 2
	18	1,336	8-B ...	Ditto	Ditto ...	61·5	131	223	475	Country ploughs ... 5
	19	1,336	Punjab 14 ...	Ditto	Ditto ..	80	201	290	728·6	Harrowing ... 8
	20	1,336	Pusa 12 ...	Ditto	Ditto ...	149·6	219	542	794	Sohagas ... 9
	21	1,336	Punjab 14 ...	Ditto	Dit' ...	31	64	112	222	Wheat harrowing ... 2
	22	1,336	17-B ...	Ditto	Ditto ...	115	287	417	1,040	According to the yields per acre the varieties stand as below :—
	23	1,336	Punjab 14 ...	Ditto	Ditto ...	76	160	275	580	*Variety.* — *Yield. per acre.*
	24	1,336	16-A ...	Ditto	Ditto ...	65·6	176	238	688	(1) Pusa 12 ... 560·7
	25	1,336	Punjab 14 ...	Ditto	Ditto ...	90	192	326	696	(2) 17-B ... 427·5
	26	1,336	Punjab 13 ...	Ditto	Ditto ...	31	72	112	261	(3) 8-B ... 423
	27	1,336	Punjab 14 ...	Ditto	Ditto ...	49	94	177·6	341	(4) 8-A ... 382
	28	1,336	Cross 8 ...	Ditto	Ditto ...	43	96	156	348	(5) Punjab 14 ... 358
	29	1,336	Punjab 14 ...	Ditto	Ditto ...	43	88	156	319	

Statement No. 4-A.

COMPARATIVE TEST OF WHEAT TYPES 8-A, PUNJAB 14, PUSA 12 IN BARANI AREA DURING RABI 1920-21.

Block Field.	Sub-plot.	Area in square yards.	Variety.	Date of Sowing.	Date of Harvesting.	Actual outturn in lbs. Grain.	Actual outturn in lbs. Straw.	Outturn per acre in lbs. Grain.	Outturn per acre in lbs. Straw.	Cultivation.	Remarks.
C/6	1	1815	Punjab 14 ...	25th October 1920.	12th April 1921	166	293	443	781	Raja plough ... 1	
	2	1815	Pusa 12 ...	Ditto	30th March 1921	240	358	640	955	Country plough ... 5	
	3	1815	Punjab 14 ...	Ditto	12th April 1921	90	342	240	912	Damaged by wind storms.	
	4	1815	8-A ...	Ditto	17th April 1921	213	393·6	568	1,061	Harrows ... 5	
	5	1815	Punjab 14 ...	Ditto	Ditto	197	440	525	1,173	Sohaga ... 8	
	6	1815	Pusa 12 ...	Ditto	30th March 1921	266·5	338	710·6	901	Wheat harrowing 2	
	7	1815	Punjab 14 ...	Ditto	17th April 1921	283	453	754·5	1,208		
	8	1815	8-A ...	Ditto	Ditto	260	475	693	1,267		
	9	1815	Punjab 14 ...	Ditto	Ditto	221·4	338	520	1,035		

Average Pusa 12 ... ... 675 lbs.
„ 8-A ... ... 630·5 „
„ Punjab 14 ... ... 510·6 „

Statement No. 4-B. Field No. B/13 Barani Area.

SHOWING THE VARIETAL TESTS OF DIFFERENT WHEAT TYPES IN THE BARANI AREA.

Serial No.	Field No.	Name of variety.	Area harvested in square yards.	Date of Sowing.	Date of Harvesting.	Actual outturn in lbs. Grain.	Actual outturn in lbs. Straw.	Outturn per acre in lbs. Grain.	Outturn per acre in lbs. Straw.	Cultivation.	Remarks.
1	B/13	Cross No. 3 ...	118	1st November 1920.	6th April 921	13·3	23·6	545·5	968·0	Raja plough ... 1	
2		G_1 ...	118	Ditto	Ditto	13·3	23·6	545·5	968·0	Harrowing ... 4	
3		G_2 ...	118	Ditto	Ditto	13·3	25·6	545·5	1,050	Country plough 4	
4		N H × P_4 48	118	Ditto	Ditto	12·3	28·7	504·4	1,177	Sohagas ... 6	
5		13 C ...	118	Ditto	Ditto	14·3	31·8	586	1,304	Wheat harrowing 2	
6		N H × P_4 165	118	Ditto	Ditto	10·25	25·6	420·4	1,050		
7		N H × P_4 80	118	Ditto	Ditto	8·2	22·6	336·2	926·8		
8		A O. 89 ...	118	Ditto	Ditto.	12·3	24·6	504·4	1,009		
9		16 A ...	118	Ditto	Ditto	9·1	29·7	373·2	1,218		
10		Pusa 4 C. P....	118	Ditto	Ditto	8·2	17·5	336·2	717·6		
11		Punjab 13 ...	118	Ditto	Ditto	5·1	21·5	209·1	881·6		

Statement No. 5.

SHOWING RESULT OF EARLY AND LATE SOWINGS OF WHEAT TYPES, DURING RABI 1920-21. RECOMMENDED BY THE AGRICULTURAL ADVISOR TO GOVERNMENT OF INDIA.

Name of variety.	Area in square yards.	Dates of Sowing.	Dates of Harvesting.	Outturn in lbs. Actual.	Outturn in lbs. Per acre.	Remarks.
		Early and late Chahi.				
A. 0-89 (C. P.) ...	397/2	2nd November 1920	6th April 1921 ...	85	2,075	
Pusa 4 (C. P.) ...	397/2	Ditto	Ditto ...	102·5	2,499	
Pusa 4 (Pusa) ...	486	14th November 1920	7th April 1921 ...	207	2,061	Tube well failed and no irrigation was possible during February and March when it was badly needed. This is the first year when these seeds had to come in new environment and as ill luck would have it, they had to contend against severe conditions. They may fare well next year.
Ditto ...	486	Ditto	Ditto ...	195	1,942	
A. O.-89 (C. P.) ...	55	1st December 1920 ...	16th April 1921 ...	5	440	
Red Athni	Bombay wheats destroyed on account of black rust and also for being bad mixtures.					
Katha Dohad ...						
Pusa 4 (Pusa) from Agricultural Advisor to Government of India.	175	17th January 1921 ...	29th April 1921 ...	4	111	(Owing to failure of tube well pump it was not possible to irrigate it during February and March when it was most needed.)
		Early and late Barani.				
A. O.-89	118⅔	1st November 1920 ...	6th April 1921 ...	12·3	503	The same remarks apply here. The season was awfully bad for such a new trial. It may be possible to get better results next year.
Pusa 4 (C. P.) ...	118⅔	Ditto ...	Ditto ...	8·2	335	
A. O.-89 (C. P.) ...	68	17th November 1920	7th April 1921 ...	0	142	
Pusa 4 (C. P.) ...	68	Ditto	Ditto ...	2	142	
Pusa 4 (Pusa) ...	288	Ditto	Ditto ...	13	218	

Statement No. 6.

Field No.—B 1 (*a*)—Barani area.

SHOWING THE RESULT OF TWO MAIN BARANI WHEATS SOWN IN CONNECTION WITH THE CULTIVATION TEST AND MANURIAL TESTS IN FIELD NO.—B 1

No. of plot.	Area harvested in square yards.	Name of variety.	Date of sowing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.
					Grain.	Straw.	Grain.	Straw.	
1	403⅓	8-A	18th October 1920		71·8	153·7	861·6	1,844·4	
1	403⅓	Punjab-14	Ditto		65·6	114·8	787·2	1,377·6	
2	403⅓	8-A	Ditto		59 5	135·3	714·0	1,623·6	
2	403⅓	Punjab-14	Ditto		53·5	117·0	642·0	1,404 0	
3	403⅓	8-A	Ditto		54·3	108 6	651·6	1,279·2	
3	403⅓	Punjab-14	Ditto		69·7	123·0	836·4	1,476·0	
4	403⅓	8-A	Ditto		55·3	92 0	663·6	1,104·0	
4	403⅓	Punjab-14	Ditto		53·3	110·7	639·6	1,328·4	
5	403⅓	8-A	Ditto		57·5	118·9	690·0	1,428·8	
5	403⅓	Punjab-14	Ditto		60·5	112·7	726·0	1,352·4	
6	403⅓	8-A	Ditto		43·0	84·0	516·0	1,008·0	
6	403⅓	Punjab-14	Ditto		41·0	71·7	492·0	860·4	
7	403⅓	8-A	Ditto		45·0	108·6	540·0	1,303·2	
7	403⅓	Punjab-14	Ditto		33·8	71·7	405·3	860·4	
8	403⅓	8-A	Ditto		55·4	92·0	664·8	1,004·0	
8	403⅓	Punjab-14	Ditto		41·0	82·0	492·0	984·0	
9	403⅓	8-A	Ditto		41·0	112·7	492·0	1,352·4	
9	403⅓	Punjab-14	Ditto		37·9	84·0	454·8	1,008·0	
10	403⅓	8-A	Ditto		45·0	98 4	540·0	1,180·8	
10	403⅓	Punjab-14	Ditto		52·3	102·5	627·6	1,230·0	
11	403⅓	8-A	Ditto		49·0	94·3	588·0	1,131·6	
11	403⅓	Punjab-14	Ditto		54·3	100·5	651 6	1, 06·0	
12	403⅓	8-A	Ditto		59·5	114·8	714·0	1,377·6	
12	403⅓	Punjab-14	Ditto		49·0	98·4	588·0	1,180·8	
13	403⅓	8-A	Ditto		43·0	131·2	516·0	1,574·4	
13	403⅓	Punjab-14	Ditto		54·6	98·4	655·2	1,180·8	
14	403⅓	8-A	Ditto		48·0	90·0	516·0	1,180·0	
14	403⅓	Punjab-14	Ditto		54·3	94·3	651·6	1,131·6	

8-A harvested on 19th April 1921.
Pb.-14 harvested on 22nd April 1921.

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Statement No. 6—*continued.*

Field No. B — 1 Barani area.

SHOWING THE RESULT OF TWO MAIN BARANI WHEATS SOWN IN CONNECTION WITH THE CULTIVATION AND MANURIAL TESTS, ETC

No. of plot.	Area harvested in square yards.	Name of variety.	Date of sowing.	Date of harvesting.	Actual yield in lbs.		Yield per acre in lbs.		Remarks.
					Grain.	Straw.	Grain.	Straw.	
15	403⅓	8-A	18th October 1920	8-A bits harvested on 18th, 19th September 1921. Punjab-14 bits harvested on 21st, 22nd September 1921.	55·3	98·4	663·6	1,180·8	*Cultivation*— Desi, Sabbul in their respective plots and Raja in the rest of the field for the first time. Other cultivation is as follows:— Harrowing ... 7; Country plough ... 4; Sohagas ... 7; Wheat harrowing ... 5
15	403⅓	Punjab-14	Ditto		55·3	82·0	663·6	984·0	
16	403⅓	8-A	Ditto		43·0	82·0	516·0	984·0	
16	403⅓	Punjab-14	Ditto		44·0	82·0	528·0	984·0	
17	403⅓	8-A	Ditto		41·0	82·0	492·0	984·0	
17	403⅓	Punjab-14	Ditto		37·3	86·0	447·6	1,032·0	
18	403⅓	8-A	Ditto		36·9	73·8	442·8	885·6	
18	403⅓	Punjab-14	Ditto		34·8	79·9	417·6	958·8	
19	403⅓	8-A	Ditto		33·8	71·7	405·6	860·4	
19	403⅓	Punjab-14	Ditto		52·0	90·2	624·0	1,082·4	
20	403⅓	8-A	Ditto		30·7	61·5	368·4	738·0	
20	403⅓	Punjab-14	Ditto		30·7	71·7	368·4	860·4	
21	403⅓	8-A	Ditto		41·0	82·0	492·0	984·0	
21	403⅓	Punjab-14	Ditto		34·8	65·5	417·6	787·2	
22	403⅓	8-A	Ditto		31·3	61·5	375·6	738·0	
22	403⅓	Punjab-14	Ditto		26·6	71·7	319·2	860·4	
23	403⅓	8-A	Ditto		33·8	61·5	405·6	738·0	
23	403⅓	Punjab-14	Ditto		35·9	61·5	430·8	738·0	
24	403⅓	8-A	Ditto		40·0	75·8	480·0	909·6	
24	403⅓	Punjab-14	Ditto		46·0	71·7	552·0	860·4	
25	403⅓	8-A	Ditto		54·0	112·7	648·0	1,352·4	
25	403⅓	Punjab-14	Ditto		57·4	102·5	688·8	1,230·0	

Average yield ... 8-A = 558·3 lbs.
Punjab-14 = 564·3 lbs.

Statement No. 6-A

Field No. B — 1 Barani area.

SHOWING THE EFFECT OF CULTIVATION ON WHEAT IN BARANI AREA.

1	2	3	4	5	6	7		8		9	10
No. of plot.	Area harvested in square yards.	Name of variety.	Cultivation.	Date of sowing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Details of cultivation.	Remarks.
						Grain	Straw.	Grain.	Straw.		
		(Half and half)									
1	806⅔	8-A and Punjab 14.	Non-harrowed	18th October 1920.	8-A bits harvested on 18-19th April 1921. Punjab 14 bits harvested on 21st-22nd April 1921.	138	269	828	1,614		Average Yields per acre.
2	806⅔	Ditto	Harrowed ...	Ditto		113	252	678	1,512	Raja ... 1 Country plough 4 Harrowing .. 7 Sohagas ... 7 Wheat harrowing = 5 (only in Harrowed plots.)	*Non-harrowed.* Yield per acre 759·6.
3	806⅔	Ditto	Non-harrowed	Ditto		124	230	744	1,380		*Harrowed.* Yield per acres 609·6
4	806⅔	Ditto	Harrowed ...	Ditto		108	203	648	1,218		
5	806⅔	Ditto	Non-harrowed	Ditto		118	232	708	1,392		*Sabbul plough.*
6	806⅔	Ditto	Harrowed ...	Ditto		84	156	504	936		Yield per acre 522.
7	806⅔	Ditto	Sabbul plough	Ditto		79	180	474	1,080	Sabbul ... 1 (In respective plots for the first time.)	Country 601·8.
8	806⅔	Ditto	Country plough	Ditto		96	174	576	1,044		
9	806⅔	Ditto	Sabbul plough	Ditto		79	197	474	1,182	Country plough 2.	
10	806⅔	Ditto	Country plough	Ditto		97	201	582	1,206	Common for country and the Sabbul. Country flow = 4. Harrowing 7 Sohagas 7 Wheat harrowing ... 7	
11	809⅔	Ditto	Subbul plough	Ditto		103	195	618	1,170		
12	806⅔	Ditto	Country plough	Ditto		108	213	648	1,278		

Statement No. 6-B

Field No. B — 6 Barani area.

SHOWING THE RESULT OF COMPARATIVE TEST OF RAJA *VERSUS* DESI PLOUGH (CULTIVATION).

Serial No.	Cultivation and name of variety sown.	Area harvested in square yards.	Date of sowing.	Date of harvesting.	Actual outturn in lb.		Outturn per acre in lb.		Remarks.
					Grain.	Straw.	Grain.	Straw.	
1	Raja plough, Pusa 12.	2,749	20th October 1920.	6th April 1921	307·5	717·5	541·3	1,263	*Cultivation* :—
2	Raja plough, 8-A.	2,897	Ditto	Ditto	287	635·5	479·4	1,061	Raja plough plots: Raja plough ... 1, Harrowing ... 4, Country plough ... 3, Sohagings ... 7
3	Desi plough, Pusa 12.	2,462	Ditto	Ditto	354·6	750·3	693·9	1,475	Desi plough plots: Desi plough ... 2, Harrowing ... 4, Country plough ... 3, Sohaga ... 7
4	Desi plough, 8-A...	2,598	Ditto	Ditto	252	881·5	469·4	1,642	

Statement No. 6-C.

SHOWING THE RESULTS OF PERMANENT WHEAT AND PERMANENT WHEAT AND GRAM PLOTS SINCE THEIR ESTABLISHMENT.

Year.	Rainfall.	Field No.	Variety.	Outturn per acre in lbs.	Remarks.
1913-14 ...	27·57″	B / 1 b	...	...	No crop sown.
1913-14 ...	27·57″	B / 2 b	Pusa 12	1,804	Permanent wheat plot started for the first year.
1914-15 ...	54·10″	B / 1 b	Pusa 12 + local gram ...	690	
1914-15 ..	54·10″	B / 2 b	Pusa 12	939	
1915-16 .	17·88″	B / 1 b	Pusa 12 + local gram ...	1,117	Cultivation in 1920-21—
1915-16 ...	17·88″	B / 2 b	Pusa 12	1,043	Raja plough ... ... 2 Harrowing 3
1916-17 ...	37·86″	B / 1 b	Pusa 12 + local gram ...	710	Country plough 3
1916-17 ...	37·86″	B / 2 b	Pusa 12	940	Sohaga 6
1917-18 ...	53·37″	B / 1 b	Pusa 12 + local gram ...	392	After culture—Bar harrowings... 3
1917-18 ...	53·37″	B / 2 b	Pusa 12	874	Date of sowing—16th October 1920.
1918-19 ...	17·71″	B / 1 b	Pusa 12 + local gram ...	1,376	Date of harvesting—30th March 1921.
1918-19 ...	17·71″	B / 2 b	Pusa 12	1,324	
1919-20 ...	30·94″	B / 1 b	Pusa 12 + local gram	1,044	
1919-20 ...	30·94″	B / 2 b	Pusa 12	1,063	
1920-21 ..	20·97″	B / 1 b	Pusa 12 + local gram ..	504	
1920-21 ...	20·97″	B / 2 b	Pusa 12	575	

Statement No. 7.

SHOWING RESULTS OF GREEN MANURING EXPERIMENTS WITH "BHANG" IN BARANI AREA DURING RABI 1920-21.

Block field.	Area in square yards.	Variety.	Treatment.	Date of sowing.	Date of harvesting.	Actual outturn in lbs.		Outturn per acre in lbs.		Remarks.	Remarks.
						Grain.	Straw.	Grain.	Straw.		
C 1 — 1	480	Punjab 14	'Bhang' 24 maunds.	20th October 1920.	8th April 1921	44	96	444	968	Cultivation—	Germination in all 'Bhang' plots was good while in control ones it was little inferior. General conditions regarding white-ant attack, drought, tillering, colour, etc., were in just the same proportional ratio as to the 'Bhang' crops buried in different plots. Control plots were poor in all respects, there was practically no tillering, only one or two off-shoots per stool; white-ant attack about 50 per cent. If the season remained favourable the difference in outturns would be much marked. Up to the end of February the condition of 'Bhang' plots was very good.
2		Do.	Control ...	Ditto	Ditto	23·5	43	237	434	Raja plough 1	
3		Do.	'Bhang' 48 maunds.	Ditto	Ditto	48·2	102·5	486	1,033	Country plough 2 Harrowing 5	
4		Do.	Control ...	Ditto	Ditto	24·6	55	248	555	Sohaga 5	
5		Do.	'Bhang' 72 maunds.	Ditto	Ditto	51·3	129	517	1,301	Wheat harrowing 5	
6		Do.	Control ..	Ditto	Ditto	26·6	55	268	555	Bhang buried on 9th, 10th August 1920.	
7		Do.	'Bhang' 24 maunds.	Ditto	Ditto	43	108	434	1,089		
8		Do.	Control ...	Ditto	Ditto	24·6	55	248	575		
9		Do.	'Bhang' 48 maunds.	Ditto	Ditto	53·3	145·5	537	1,467		
10		Do	Control ...	Ditto	Ditto	25·6	65·5	258	660		
11		Do.	'Bhang' 72 maunds.	Ditto	Ditto	61·5	178	620	1,795		
12		Do.	Control ...	Ditto	Ditto	26·6	106	268	1,069		

Statement No. 8. Field No. B—1.

SHOWING THE EFFECT OF BONE MEAL RESIDUE AND SUPERPHOSPHATE ON BARANI WHEAT.

1	2	3	4	5		6		7		8		9	10	11	12
Plot No.	Area harvested in square yards.	Variety.	Treatment.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease per acre in lbs.		Money value of column 6.		Total column 7.	Price of manure per acre.	Profit or loss per acre.	Remarks.
				Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain at Rs. 6-8-0 per 82 lbs.	Straw at Rs. 2-9-0 per 82 lbs.				
13		Equal area half and half 8-A + Punjab 14.	Residue Bone meal 5 cwt. per acre...	97·6	229	586	1,374	...	270	Rs. A. P. ...	Rs. A. P. 8 7 0	Rs. A. P. 8 7 0	Rs. 12-8-0 at Rs. 100 per ton.	Loss ... Rs. A. P. 4 1 0	In case of Bone meal only half the price of the manure has been taken as it is the residual effect which benefits the wheat of this year.
14		Half and half 8-A + Punjab 14.	No manure	97·6	184	586	1,104	Control.		Control.		Control.		...	
15		Ditto	Residue Bone meal 5 cwt. per acre	110	180	660	1,080	138	96	10 15 0	3 0 0	13 15 0	Rs. 12-8-0.	Grain ... 1 7 0	Average yield —
16		Litto	No manure	87	164	522	984	Control.		Control.		Control.		...	Bone meal residue plots yield per acre—
17	2 806	Ditto	Residue Bone meal	78	168	468	1,008	36	84	2 13 9	2 10 0	7 9	Rs. 12-8-0.	Loss ... 7 0 3	Grain ... 571·2 lbs.
18	3	Litto	No manure	72	154	432	924	Control.		Control.		Control.		...	Straw ... 1113·8 lbs.
19		Ditto	Superphosphate at 1½ cwt. per acre	86	162	516	972	147	174	11 10 6	5 7 0	17 1 6	Rs. 13-14-0 at Rs. 185 per ton	Grain ... 3 3 6	Supe phosphate plot yield per acre—
20		Ditto	No manure	61·5	133	369	798	Control.		Control.		Control.		...	Grain ... 486.0 lbs.
21		Ditto	Superphosphate at 1½ cwt. per acre	76	147	456	882	108	84	8 9 0	2 10 0	11 3 0	Rs. 13-14-0.	Loss ... 2 11 0	Straw ... 927.0 lbs.
22		Ditto	No manure	68	133	348	798	Control.		Control.		Control.		...	

Statement No. 9. Field No. B—3.

SHOWING THE COMPARATIVE TEST OF DIFFERENT MANURES ON WHEAT (8-A) IN THE BARANI AREA.

1	2	3	4	5		6		7		8		9	10	11	12
Plot No.	Name of variety.	Area harvested in square yards.	Treatment.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease per acre in lbs.		Money value of column 7.		Total of column 8.	Price of manure per acre.	Profit or loss per acre.	Remarks.
				Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain at Rs. 6-8-0.	Straw at Rs. 2-9-0.				
1	8-A	879	Control	94	336	517·5	1,299	...	...	Rs. A. P. ...	Rs. A. P. ...	Rs. A. P. ...	Rs. A. P. ...	Rs. A. P. ...	Date of sowing —2nd November 1920.
2			Ammonium Sulphate	104·5	225	575·1	1,239	+57·6	—60	4 9 0	1 14 0	+2 11 0	16 3 9	—(13 8 9)	Date of harvesting—21st April 1920.
3			Ammonium Sulphate + Superphosphate ...	98	229	539·5	1261	+22	—38	1 11 11	1 3 0	+0 8 11	24 2 6	—(23 9 7)	Cultivation.
4			Ammonium Sulphate + Bone meal ...	94	205	517·5	1129	...	—170	...	5 5 0	—5 5 0	19 9 3	—(24 14 3)	Raja plough 1
5			Control	82	180	451·4	991·0	...	...	...	...	...	...	...	Country plough 5
6			Ammonium Sulphate	82	195	451·4	1,074	...	+83	...	2 9 6	+2 9 6	16 3 9	—(13 10 3)	Harrowings 7
7			Ammonium Sulphate + Superphosphate ...	86	225	473·5	1,239	+22·1	+247	1 12 0	7 11 6	+9 7 6	24 2 6	—(14 11 0)	Sohagas 8
8			Ammonium Sulphate + Bone meal ...	74	195	407·4	1,974	—44	+ 83	3 7 10	2 9 6	+0 14 4	19 9 3	—(20 7 7)	Wheat harrowings 4
9			Control	76	195	418·4	1,074	...	...	...	...	...	...	...	
10			Ammonium Sulphate	86	155	473·5	853·3	+55·2	—22·7	4 5 11	6 14 4	—2 8 5	16 3 9	—(18 12 2)	
11			Ammonium Sulphate + Superphosphate ...	88	164	484·5	902·8	+66·1	—170	5 3 10	5 5 0	—0 1 2	24 2 6	—(24 3 8)	
12			Ammonium Sulphate + Bone meal ...	86	180	473·5	991·0	+55·1	—83	4 5 11	2 9 6	+1 12 5	19 9 3	—(17 12 10)	

Statement No. 10

SHOWING THE COMPARATIVE RESULTS OF MANURES ON WHEAT IN BARANI IN 1920-21.

Block field.	Sub-plot.	Area in square yards.	Treatment.	Variety.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease in lbs.		Price of grain at Rs. 6-4-0 per maund.	Price of straw at Rs. 2-9-0 per maund.	Total of columns.	Price of manure.	Profit or loss.	Remarks.
					Grain.	Straw.	Grain.	Straw.	Grain.	Straw.						
											Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	
C 1	1	677	Control	Punjab 13 ...	45	96	322	686	...	...	...	...	...	...	...	Raja plough 1
	2	677	Ammonium sulphate at 20 lbs. N. per acre.	Ditto 13 ...	53	119	379	851	+ 57	+ 165	4 5 0	5 2 6	9 8 0	13 7 0	— 3 15 0	Country ploughs ... 2
	3	677	Super. at 15 lbs. P_2O_5 per acre.	Ditto 13 ...	46	102	329	729	+ 7	+ 43	1 1 3	1 5 6	2 6 9	7 2 0	— 4 11 3	Harrowing 5
	4	677	Control	8-A ...	48	111	343	793	...	...	...	...	...	...	...	Sohagas 5
	5	677	Ammoniam Sulphate at 20 lbs. N. per acre.	8-A ...	72	129	515	922	+ 172	+ 129	13 2 6	4 0 6	17 2 6	13 7 0	+ 3 11 6	Wheat Harrowing ... 2
	6	677	Super. at 15 lbs. P_2O_5 per acre.	8-A ...	81	131	579	936·5	+ 236	+ 143·5	17 15 9	4 7 6	22 7 3	7 2 0	+ 15 5 3	
	7	820	Control	Punjab 13 ...	74	130	437	106·3	...	...	...	...	...	...	...	
	8	820	Ammonium Sulphate at 20 lbs. N per acre + Super. at 15 lbs. P_2O_5 per acres.	Ditto 13 ...	60·5	137	357	808·5	— 80	— 254·5	6 1 6	7 15 0	— 14 0 6	20 9 0	— 34 9 6	
	9	820	Control	8-A ...	27	51	159	301	...	...	...	...	...	...	...	
	10	820	Ammonium Sulphate + Super.	8-A ...	33	72	195	425	+ 36	+ 124	2 11 9	3 14 0	+ 6 9 9	25 9 0	— 13 15 3	

Date of sowing ... 25th October 1920.
Date of harvesting ... 12th April 1921.

Statement No. 11

SHOWING THE RESULT OF BONE-MEAL AND SUPERPHOSPHATE IN CONJUNCTION WITH GREEN MANURING IN THE "CHAHI" AREA.

Block field.	Area in square yards.	Treatment.	Variety.	Actual outturn in lbs.		Outturn per acre in lbs.		Increase or decrease in lbs.		Price of grain at Rs. 6-4-0 a maund.	Price of straw at Re. 2-9 0.	Total of columns 8 and 9	Price of manure.	Profit or loss.	Remarks.
				Grain.	Straw.	Grain.	Straw.	Grain.	Straw.						
										Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Cultivation. *Implement used* — *No. of times.*
1		Unmanured	8-A	99	164	1,277	2,116	...	...	...	...	...	...	...	
2		Green manured	8-A	83	184	1,071	2,373	...	...	...	...	...	...	...	Raja plough ... 1
3		Green manured + Superphosphate at 30 lbs. P_2O_5 per acre.	8-A	92	236	1,188	3,045	— 89	+ 929	— 6 12 9	29 0 6	22 3 9	13 13 6	+ 8 6 3	Country plough ... 5 Harrowings ... 2 Sohagas ... 6 Wheat-harrowing ... 1
4		Green manured + Bone-meal at 30 lbs. P_2O_5 per acre.	8-A	96	252	1,239	3,251	— 38	+ 1,135	— 2 14 0	+ 35 7 6	+ 32 9 6	5 13 6	+ 26 12 0	
5		Green Manure	8-A	115	225	1,485	2,904	...	..	...	...	...	...	...	*Waterings.*
6		Green manured + Superphosphate at 30 lbs. P_2O_5 per acre.	8-A	123	256	1,588	3,304	+ 311	+ 1,188	+ 23 14 9	37 2 0	+ 61 0 9	13 13 6	+ 47 3 3	(1) 24th December 1920. (2) 26th March 1921.
7		Green manured + Bone-meal at 30 lbs. P_2O_5 per acre.	8-A	108	246	1,394	3,175	+ 117	+ 1,059	+ 9 0 0	+ 13 1 6	+ 42 1 6	5 13 6	+ 36 4 0	Date of sowing ... 4th November 1920.
A 10	375	Unmanured	Pusa 12	113	287	1,458	3,704	...	...	...	...	...	...	...	Data of harvesting 6th April 1920.
9		Green manured	Ditto	95	254	1,226	3,277	...	...	...	...	...	...	...	
10		Green manured + Superphosphate at 30 lbs. P_2O_5 per acre.	Ditto	104	287	1,342	3,704	— 116	...	— 8 14 9	...	— 8 14 9	13 13 6	— 22 12 18	
11		Green manured + Bone-meal at 30 lbs. P_2O_5 per acre.	Ditto	95·5	299	1,232	3,859	— 226	+ 155	— 17 4 0	+ 4 13 6	— 12 6 6	5 13 6	— 18 4 0	
12		Green manured	Ditto	137	471	1,768	6,078	...	...	...	...	...	...	...	
13		Green manured + Superphosphate at 30 lbs. P_2O_5 per acre.	Ditto	183	481	1,717	6,207	+ 259	+ 2,503	+ 19 14 9	+ 78 3 6	+ 98 2 3	13 13 6	+ 84 4 9	
14		Green manured + Bone-meal...	Ditto	127	348	1,639	4,491	+ 181	+ 787	+ 13 14 9	+ 24 9 6	+ 38 8 3	5 13 6	+ 32 10 9	

Statement No. 12

SHOWING THE RESULT OF MANURIAL EXPERIMENT WITH SUGARCANE IN CHAHI FOR THE YEAR 1920-21.

Block field.	Variety.	Date of sowing	Treatment.	Area in square yards.	Weight in lbs. of			Weight per acre in lbs. of			Percentage of			Crushing date.	Remarks.
					Canes.	Juice.	Gur.	Canes.	Juice.	Gur.	Juice to canes.	Gur to juice.	Gur to canes.		
A 12	Dhoulu.	29th March 1920.	Farmyard at 600 maunds per acre.	520	2,593	1,357	221·4	24,135	12,631	2,060	52·32	16·32	8·53	13th December 1920.	30 per cent lodged.
			Townsweeping at 600 maunds per acre.	344	2,122	1,148	180·4	29,856	16,119	2,538	54 37	15·71	8·54	Ditto	20 per cent. lodged,
			Castor cake at 60 maunds per acre.	195	1,230	574	90·2	30,530	14,244	2,239	46·67	15·71	7·33	12th December 1920.	Badly lodged.
			Sodiumnitrate at 3 cwt. per acre.	435	2,983	1,328	209·1	33,190	14,656	2,321	44·52	15·74	7·09	Ditto	25 per cent. lodged.

Details of cultivation.—Desi plough = 7, harrow = 2, Sohaga = 8, four hoeings with baguri and one with spade.

Waterings on—(1) 21st April 1920, (2) 26th May 1920, (3) 17th June 1920, (4) 3rd July 1920, (5) 1st September 1920, and (6) 13th October 1920.

Statement No. 13.—Block D—Barani Cultivation—Field Nos. 5 and 6.

SHOWING THE COMPARATIVE RESULTS OF DIFFERENT GRAM VARIETIES.

No.	Field No.	Name of variety.	Area harvested in square yards.	Actual yield in lbs.	Yield per acre in lbs.	Cultivation.	Remarks.
1	D 5 and 6.	Register No. 7 ...	1,262	252	966	Raja plough = 1. Country plough = 2 Harrowing = 5. Sohagas = 7 ... Gram harrowing = 2	
2		Register No. 15 ...	1,262	320	1,227		
3		Register No. 17 ...	1,262	373	1,430		Register No. 17 and Register No. 20 gave highest yields.
4		Register No. 20 ...	1,362	373	1,430		
5		Small Kablies ...	1,262	305	1,169		
6		Large Kablies ...	1,262	213	816·3		
7		Local gram ...	8,836	2,423	1,326		

Statement No. 14—Field No. $\frac{D. B.}{4}$—Chahi Area.

SHOWING THE RESULTS OF FEDERATION WHEAT (LATE SOWING).

Field No.	Variety.	Area harvested in square yards.	Date of sowing.	Date of harvesting.	Actual yield in lbs.		Outturn per acre in lbs		Remarks.
					Grain.	Straw.	Grain.	Straw.	
$\frac{B}{46}$	Federation wheat.	3,380	19th November 1920.	11th April 1921	807·7	1,773	1,157	2,487	*Cultivation*— Country ploughs=4. Harrowings =3. Sohagas =8. Wheat-harrowing=1. *Waterings*— 20th January 1920. 20th March 1921.

Statement No. 15.

STATEMENT SHOWING THE MOISTURE CONTENTS IN THE SAMPLES OF SOIL TAKEN FROM THE GOVERNMENT FARM, GURDASPUR.

Description of sample.	Moisture per cent.	Description of sample.	Moisture per cent.	
$\frac{B}{1}$ Field—, plot 7, subhal plough ..1st 9″	2·99	$\frac{B}{1}$ Field—, plot 8, desi plough...1st 9″	2·72	
$\frac{B}{1}$ Field—, plot 7, subhal plough ..2nd 9″	6·05	$\frac{B}{1}$ Field—, plot 8, desi plough...2nd 9″	4·08	1st set of experiment versus desi plough.
$\frac{B}{1}$ Field—, plot 7, subhal plough...3rd 9″	6·93	$\frac{B}{1}$ Field—, plot 8, desi plough...3rd 9″	6·88	
$\frac{B}{1}$ Field—, plot 9, subhal plough ..1st 9″	2·05	$\frac{B}{1}$ Field—, plot 10, desi plough...1st 9″	2·78	
$\frac{B}{1}$ Field—, plot 9, subhal plough ..2nd 9″	4·43	$\frac{B}{1}$ Field—, plot 10, desi plough ..2nd 9″	4·99	2nd set of experiment duplicate of 1st set.
$\frac{B}{1}$ Field—, plot 9, subhal plough ..3rd 9″	6·04	$\frac{B}{1}$ Field—, plot 10, desi plough ..3rd 9″	6·90	
$\frac{B}{6}$ Field—, plot 1st, desi plough...1st 9″	0·78	$\frac{B}{6}$ Field—, plot 2nd, Raja plough ..1st 9″	1·32	
$\frac{B}{6}$ Field—, plot 1st, desi plough...2nd 9″	2·26	$\frac{B}{6}$ Field—, plot 2nd, Raja plough...2nd 9″	4·03	3rd set of experiment desi plough versus Raja plough.

Annual report of the Sargodha Farm for the year 1920-21.

Introductory and General.—The farm was first started in 1904 with a view to grow and multiply pure strains of the more important crops like wheat and cotton in the Lower Jhelum Colony. The management and actual cultivation was entrusted to the local district authorities but owing to the inexperience of the officials concerned in agricultural matters and various other causes the subject in view remained unfulfilled. In 1913 the farm was handed over to the Agricultural Department and up to 1916-17 it served only as a "Seed Farm", after which experimental work was started. Therefore 1918 was the first year of experimental undertaking on this farm.

In my last report it was pointed out that in order to enable experimental work to be conducted the ordinary Killa shaped fields had to be broken and a good deal of levelling and consequent shifting of the weathered surface-soil had to be done which temporarily diminished the fertility of the land and seriously altered the uniformity in the soil texture. To some extent these defects have been overcome since the inception of the experimental work but their effects are still apparent and a good deal of caution is required in interpreting the results of the various experiments at present.

Besides the initial disadvantages which every new Farm on its commencement has to face and to recover from which a long term of years is required the Sargodha Farm has been more especially unfortunate in respect of canal water supply. The outlet of the khal on which the farm (along with 7 other share holders) is situated at a distance of 2 miles from the farm and is 8″ × 9″ in dimension. The canal authorities reduced it in 1913, but on reconsideration the old dimensions were restored. In 1919 the reduction to the outlet was again made on the ground that the farm was irrigating more than the fixed percentage of the area, neglecting the fact that with judicious tillage and careful handling of water the actual "Haq" and no more was being made use of. The fact was at last brought to the notice of the canal officers who have again restored the old dimensions of 8″ × 9″. This has to a large extent removed a very great grievance of the farm which is expected to improve rapidly in future.

Rainfall.—The distribution of the rains is of equal magnitude to the total fall during the year, and though it is not a matter of life or death in the canal colonies it is considered a great Providential boon whenever it does fall. Considering the very scanty water supply for the farm the benefits of the rains are easily understood.

Table giving the rainfall for the last 3 years :—

	1918-19.	1919-20.	1920-21.
	Inches.	Inches.	Inches.
July	1·90	3·03	1· 74
August	1·77	4·40	2· 70
September	·82	*Nil*	0· 80
October	0·05	*Nil*	*Nil*
November	*Nil*	*Nil*	*Nil*
December	2·8	1·03	*Nil*
January	0·89	0·25	0· 02
February	0·03	0·65	*Nil*
March	*Nil*	0·98	0· 08
April	0·44	0·06	*Nil*
May	0·64	0·81	*Nil*
June	*Nil*	0·09	*Nil*
Total.	6·82	11·30	5· 34

It is noticed that the total fall during the year is extremely small. The first three months, *i e.*, July, Augu st and September, which are mainly the monsoon months contributed only 5·24″ and the remainder of the year was practically rainless as the two showers of ·02″ and .08″ in January and March respectively are negligible. The extremely dry weather coupled with very scanty canal water told very heavily on the American cotton. The sowing of wheat, toria, gram, etc., was rendered difficult or rather impossible as the canal water could not even "rowny" (preparatory irrigation) the stubbles to be prepared for the seed beds. Sowing of fodders was another gigantic trouble and owing to complete absence of water grams were sown "barani" in fields where some moisture was believed to have been preserved after the ·80″ of September. With no rain and with practically no canal supply the wheat, toria, gram etc., had to struggle as best as they could during almost the whole of their lives and simultaneously to resist the disastrous effects of the parching wind storms.

The cotton crop had partially failed and done away with in November because no irrigation was possible during September or October and consequently the crop was unable to mature its seed let aside the experimental object.

Experimental.—The following experiments have been conducted during the year :—

1. Continuation of wheat varietal tests and Mr. Howard's wheats.
2. Water saving experiment with wheat and toria,
3. Varietal tests of American and Desi cottons.
4. Spacing experiments with cotton.
5. Comparative tests of Economic Botanist's gram varieties,
6. Fodders.

A. Local and French Oats.

B. Juar varieties.

Wheats.

1.-A. *Wheat varietal tests* (*Statement* 4)

The following varieties were tested-with-8A as standared :—

8-B
Punjab 14
Punjab 11
17-B
Pusa 12
9-C
C-13

All these wheats were tested last year and from their result it was deduced that 8-A was the best. Though Pusa 12 yielded higher than 8-A yet for various well known reasons it is not likely to be a universal wheat Punjab 11 stood close second to 8-A.

The fields on which these varieties were grown had been under the previous wheat crop harvested in April. Owing to deficient water supply the stubbles could not be broken until the middle of May and thus we lost one months summer fallow. This was followed by a most unfavourable weather with a total fall of 0·01″ of rain from October to April. The canal water supply was also in a deplorable condition and only just enabled the crop to survive throughout the winter. The effects of the above calamities were still further intensified by blowing of hot and scorching winds during March and April at the time when the grains were approaching maturity. The sudden approach of hot weather with abnormally high temperatures during March and April hastened premature ripening resulting in a very great percentage of shrivelled grains. Hence the very low outturns on the farm this year. Inspite of such severe ordeals 8-A with 19 maunds 12 seers 12 chataks per acre tops the list. Unfortunately the land allotted to Punjab 14 and No. 11 and other adjacent plots on both sides of No. 11 were poor and so the results are inconclusive.

On the whole 8-A has in almost all plots yielded higher outturns than its adjacent plots except in one instance where 9·C has the advantage of a few seers but this is perhaps accidental. Taking everything into account (with the exception of two bits under 8-A where the land is very poor) the following is the order of merit :—

Variety	Outturn			Remarks.
	Maunds	Seers	Chataks	
8-A. ...	14	18	4	Per acre.
Pusa 12 ...	13	1	10	„ „
8-B ...	12	22	5	„ „
9-C. ...	11	38	15	„ „
17-B ...	11	26	11	„ „
C-13 ..	6	21	5	„ „

Both Pusa 12 and 8-B always suffer by shedding grain and their yields have, therefore, been greatly reduced by high winds blowing after they were reaped.

With regard to the outturn of Bhusa (a matter of pressing importance in fodder famine year like this) the 8-B and Pusa 12 occupy the top inspite of insufficient watering. 8-A comes close 3rd, but it was reaped with the Rajah reaper while the others were cut with the hand sickle. This accounts for some decrease in the outturn of Bhusa in 8-A, as crop cut with the reaper results in a certain amount of waste.

B.—Comparative tests of 8-A, 8-B, Punjab 11, Pusa 12.—(Statement Nos. 5 and 6). 8-A and Punjab 11 are the two rival wheats in the colonies. The test was made along with the other two good yielding varieties 8-B and Pusa 12 in order to determine the superiority of one over the other. Last year's experiments were somewhat in favour of 8-A over Punjab 11 and this year's results again confirm the superiority of 8-A though the margin is very limited, *i.e.* (8-A getting the better of Punjab 11 by 8 seers 8 chataks only). In the statement 5 the Punjab 11 with 19 maunds 31 seers stands first while 8-A with 16 maunds 33 seers and 3 chataks comes next. Pusa 12 and 8-B occupy the last two places. But in statement 6 the 8-A with 19 maunds 13 seers and 6 chataks stand first while Punjab 11 with 16 mannds 7 seers and 1 chatak comes next followed by 8-B and Pusa 12 in order of merit. The average of the two plots taken together puts 8-A with 18 maunds 3 seers and 3 chataks on the top and Punjab 11 with 17 maunds 39 seers next. Pusa 12 in its turn beats 8-B by a nominal figure of 5 seers 1 chatak.

C. Comporative tests of Howard's wheats.

NH 53 × P-4 and NH 98 × P-4

(*Statement* 9).

These wheats which are results of crosses made by Mr. Howards the Imperial Economic Botanist at Pusa have recently been introduced at Gurdaspur and Sargodha to test them with the Punjab wheats. They are both beardless and though they are some times humorously called "Ammonium Pusiates" they deserve a full trial and from the results already obtained at Gurdaspur and Sargodha appear to be useful wheats.

Owing to lack of space in the area under direct cultivation by the department these two varieties were sown on the tenants area on the 26th of October 1920. This year's yields though low cannot be compared with those of the last year, *e.g.*, 15 maunds 26 seers and 8 chataks from NH-53 × P-4 and 23 maunds 17 seers and 8 chataks from NH 98 × P-4 owing to the untoward weather conditions during their growth. Shedding of grain like the majority of other beardless varieties has been experienced this year and this is likely to cause some hesitation in their free distribution. However, their trials will be further conducted.

2. A.—*Water Saving experiments with wheat.—(Statement Nos : 7 and* 8).

The objeet of this experiment is to find out :—

(*a*) The number of waterings required to give highest yield per acre.

(*b*) The proper time at which the water should be applied.

But these are very important as at present the zamindars applies water whenever he can get it regardless of its need or otherwise. The time for application deserves careful working out as wheat appears to demand water during spring (February and March) when the growth starts afresh. But irrigation in January or April appears to have little or no benefit, and it is to be seen to what extent this is true.

The great defect in this experiment at Sargodha (like other colony land) is that on account of the vagaries of the canals, one cannot depend on receiving water on the dates fixed for irrigation or the amount of water one would like to apply and therefore this experiment would be better handled if carried out somewhere else where the water supply is certain. The Gurdaspur Agricultural Station has been proposed where the tube well will be worked whenever needed, but the farm there is so small that it cannot at present permit of this experiment to be carried out.

The actual details of the experiment have been described in previous reports. Pusa 12 wheat on account of having a deeprooted system was selected but as 8-A has become the colony wheat and is better than Pusa 12 in many respects, it will in future be adopted instead of Pusa 12. The experiment was arranged in duplicate sets with No. one, two and three waterings after sowing. The reasons for poor yields have already been explained in detail but these plots were doubly unfortunate in being sown late (on 8th of December 1920) for want of water. Moreover besides the shrivelling of grain by dry and hot winds in March and April the very heavy wind storm soon after reeping blew the sheaves many yards away from the field they were lying in and this caused an enormous amount of waste inspite of laborious and careful picking and sorting out. Hence the very mueh decereased yield. The crop being Pusa 12 was further reduced on account of a great deal of shedding.

Looking at the outturn of plots in Statements 7 and 8 it is noticed that increased amount of watering gives increased yields. This is especially true for a year like this when the " No watering " plots have almost altogether perished.

Average outturn figures :—

	1919-20.			1920-21.			
	Mds.	Srs.	chs.	Mds.	Srs.	Ch.	
No watering ...	11	17	0	0	22	3	per acre
1 Watering ...	11	39	0	2	37	5	„
2 Waterings ...	13	10	0	3	6	13	„
3 Waterings ...	16	25	0	9	6	13	„

Of course this year's restults are quite inconclusive and the experiment will be continued.

B. Water Saving Experiments with Toria.—(*Statement* 3).

The importance of this experiment was fully brought out in my last report. It was pointed out that though there is some doubt as the judicious use of water saved from wheat there was no hesitation in utilizing water saved from Toria. American cotton which requires an unfailing irrigation at its fruiting time during September and October can well share water saved from Toria. The early sowing of wheat can also utilize such savings. With this view the experiment was started in 1918-19 and continued since.

The results shown in Statement 3 with one exception clearly point to the increased yield with greater number of waterings. The one exception can well be accounted for when uneven nature of the farm soil is remembered.

Last year's figures pointed out the " No watering " after sowing gave 732-3 lbs. per acre against 617 lbs. per acre which is the average of the colony where 2 or 3 irrigations are generally applied. Also it was shown that more than one irrigation resulted not only in waste of water but actually reduced the yield.

On the other hand, this year's results are different. Except in one plot where the " No watering" gave 7 maunds 1 seer and 11 chataks, all other plots (total 4) give increased outturn with increased number of irrigations. This can be well realized when the climatic conditions of the year are borne in mind. The test with three watering was omitted this year.

The following are the average outturns for each set from 4 plots :—

	Mds.	Srs.	Chs.	
No watering after sowing ...	4	38	12	per acre.
One watering „ „ ...	6	29	12	„ „
Two waterings „ „ ...	8	25	8	„ „

These results fall fully in accordance with expectations. The year has been extremely dry and water being a limiting factor in the crop each application survived the sinking energies of the crop and hence increased outturn in each set of experiment. It is essential to arrive at some conclusion and therefore the test will be continued.

3. *Varietal tests of American and Desi cottons.*—(*Statemnet* 1).

The following varieties have been tried :—

American.	*Desi.*
4.-F.	Khanna.
885.-F.	22 Mollisoni.
280.F-.	40 Rosea.

In order to avoid cross fertilization the American and Desi varieties were grown in alternate plots and the test was duplicated. Sown between April and June all varieties made good progress till September after which they suffered heavily owing to very scanty irrigation and no rainfall. Hence the crop as a whole did not mature well and the yields in each case and particularly in the American cottons (which require irrigations during September and October have been greatly reduced. Root Rot appeared and destroyed a good deal of the crop and therefore remarks below are based on the " Area harvested " and not on the " area sown ".

The following are the total outturns —

Variety	*1st Plot*			*2nd Plot*			*Total*		
	Mds.	Srs.	Ch.	Mds.	Srs.	Ch.	Mds	Srs.	Ch.
Khana	11	20	2	17	15	10	28	35	12½
285.-F	4	12	15½	5	9	8	9	22	7½
22 Mollisoni	19	16	10	9	28	12	19	5	6
280.-F	3	8	15	3	16	0	6	34	15
40-Rosea	15	14	1	11	22	1	26	36	2
4.-F, ...	3	17	10	5	6	2	8	23	12½

It is clear that in both plots Desi cottons take the lead in outturn. It can well be understood for a year like this in which the American cottons have had to undergo very adverse conditions especially on this farm.

Amongst the Desi cottons themselves the khana with an average of 14 maunds 27 seers and 14 chataks stands first with 40 Rosea at the average of 13 maunds 18 seers one chatak second and 22 Mollisoni at the average of 9 maunds 22 seers and 11 chataks comes last.

Amongst the Americans the 285-F. with the average of 4 maunds 31 seers and 4 chataks stands first and 4-F with 4 maunds 11 seers and 14 chataks second and 280-F. with 3 maunds 17 seers and 7 chataks last of all. Although the outturn in all American cottons is extremely low this year it definitely points to the superiority of the new variety *i e.*, 285-F. which has a much larger lint than the popular 4-F. With a view of its further distribution in the colony about 10 acres have been sown in Sargodha and Chillianwala Seed Farm for the next year's seed.

The American cotton 4-F. has partially failed for the last 3 years for various reasons mentioned in my last annual report, part 1. This coupled with the fall in prices has led to somewhat decreased area under such cottons in the colonies this year. The above result-though obtained under most unnatural and abnormal circumstances further intensify the apprehenssion that the American cottons may eventually be ousted out by the more acclimatized and better yielding Desi varieties.

If one considers these outturns it becomes at once evident that the yields of American cottons of last year have been about 1—3 that of the Desis, and this is true in almost all the 3 varieties of each kind. Taking as high as Rs. 6 premium per maund fetched by American cotton over the Desi with the present low yields and low prices of the Americans, the Desi are likely to be more paying, but of course in a normal year with some rains in September and October the Americans will easily supersede Desis.

4. *Spacing Experiment with 4-F. Cotton (Statement 2).*—The object of the experiment is to ascertain the distance at which the rows of the cotton should be sown so as to give the maximum yield per acre. The last 2 or 3 years results have been very inconsistent owing to various causes and the results obtained in 1920 pointed out that on a rich soil with favourable weather condition best results were obtained from the distance of 5 feet between the rows. This year the experiment was conducted on identical lines but as the weather was extremely unfavourable and the crop had to struggle through for its existence the results are different. The average outturn of both fields stands as follows : —

Varity 4. F.—

		Mds.	srs.	chs.
(1)	3 feet apart	7	1	5
(2)	5 feet apart	6	17	10
(3)	4 feet apart	4	38	8

As owing to favourable weather in the beginning of the last crop the plants spread and covered up all the space in rows 5 feet apart and the consequent advantage of outturn in its case, the adverse weather of this year interfered with free growth and results in the favour of the rows 3 feet apart. However the experiment cannot be considered as very reliable this year and will be continued for some more years to come.

5. *Comparative tests of the Economic Botanists gram varieties.*—(*Statement 10*)—This experiment was started with the object of testing new gram varieties selected by Economic Botanist at Lyallpur against the local variety with regard to their yields per acre.

The practice in the past years was to "rowny" the plots where these varieties were to be grown though no irrigation was ever given to them after sowing. But this year for want of water no preliminary irrigation was possible.

Therefore with the abandoned hopes for canal water in the near future the crop was sown "barani" on whatever moisture could be preserved from slight shower of 0·80″ in September. No rain fell during October, Novèmber, the December and January and the showers of February and March, *i.e.*, 0·08″ were negligible. Hence the crop suffered badly from drought and appeared so scraggy that half of it had to be destroyed. There was no canal water to help it out of the difficulties. Taking into account the history of the crop it hardly leaves room to offer any comments on the outturns this year. The Economic Botanist No. 7 inspite of such conditions yielded 7 maunds 35 seers 9 chhataks per acre and can be considered very hardy and is likely to be very useful in the dry tracts, the "Thal". The experiment will be repeated next year.

6. *Fodders A Local. and French Oats.*—The neceissity of experimenting with fodder crops was emphasized in my last report where it was pointed out that owing to its being a horse-breeding colony and the zamindars being great Ghi producers large stock of animals both horses and milch cattle are maintained in the Lower Jhelum colony. The present area of the farm 5½ squares is too small for all such experiments which have of necessity to be restricted to only a few. Oats are the best horse food. A variety of

the French oats was obtained from the Sargodha Remount Depôt and tested against the local type. The French oats have large and wide leaves and require about 6 irrigations to give a good crop. Its greatest advantage is that it remains green during May and supplies green fodder at the time when there is as a rule a general scarcity of other fodders. Furthermore it is nutritious and much relished by all type of cattle. It gives at least twice as much fodder as the ordinary local oats.

This year, as an exceptional disaster to all crops in general, the yields of both the French and the local are very poor. Though the local oats can give a good crop with 3 irrigations the French variety requires at least 6, but could receive only 3, and these too at a time when a great deal of damage had already been done. The experiment will again be carried out next year.

B.—Juar varieties.—Owing to restricted area on the farm and very unsatisfactory canal water supply only a limted area could be put under some of the different Juar varieties. The following varieties were tried:—

The Taunsa Juar.

The Thal Juar.

The Emphee Juar.

And all the three gave very good results, and their seeds have been preserved for the next year's sowing. Like oats, Juar is another excellent fodder crop the need for which is greatly felt not only in the colonies but throughout the Punjab. Some more varieties have recently been arranged from Poona and a regular experimental work will be taken in hand next year in order to procure seed for distribution in the colony.

The Central Provinces and Bombay varieties have to some extent been grown at Sargodha for 4 or 5 years and have always yielded heavy crops. Their stalks are sweet and palatable, but the chief difficulty felt so far is that the plants are unable to produce seed. This may be due to insufficient watering or the climatic changes which will be studied next year when a proper trial will be taken in hand.

Miscellaneous.—Out of 5½ squares the total area of the farm 1½ squares are under the direct cultivation by the Department and the remainder is given out to tenants. Experiments are carried out on the direct cultivation area only and the tenants area is mainly devoted to multiplication of pure seeds. The whole farm is under the direct management of Q. Sami Ullah who is also in charge of the district work in the Lower Jhelum Colony.

The tenants work strictly under our instructions and make full use of modern agricultural machinery. They receive their share on half *batai* Their presence on the farm is an extremely useful advertisement.

The farm is now fully known in the lower Jhelum Colony and has begun to serve the double purpose of an experimental as well as a seed farm. The water supply has so far been most unsatisfactory but, thanks to the canal officers particularly, Mr. Cook, the Superintending Engineer, and Mr. Robertson, the Executive Engineer, the old dimensions of the farm outlet (which had been reduced) have been restored.

Although the year has been extremely dry resulting in a general partial failure of crops the farm has been almost free from any other calamities from crop pests of any kind.

A further addition to farm buildings has been made by the store keepers and a Mukaddam's quarter. The quarter for the Junior Agricultural Assistant is being constructed.

It may be added that the farm is now too small for the increased activities of the department and the kindled interest of the zemindars in agricultural matters. Detailed proposals for extension of the farm have already been submitted, and it is hoped that the Government will see its way to sanction the proposal.

Income and expenditure.—The total income from the sale of farm produce amounts to Rs. 5,509 and the expenditure during the year came to Rs. 4,074. This does not include the payment of the staff.

Staff.—It has been in charge of Q. Sami Ullah throughout the year. Q. Sami Ullah is one of the old Agricultural Assistants, and is exceptionally well suited to farm management as well as the district work. Through his experience and acquaintance with the zemindars he has been successful in making the farm well known throughout the colony.

M. SULTAN ALI.

Dy. Director of Agriculture, 1st circle, Gurdaspur.

STATEMENT SHOWING THE RESULTS OF DESI AND AMERICAN COTTONS VARIETIES TESTED IN KHARIF 1920 AT THE SARGODHA SEED FARM.

No. of plot.	Previous crop.	Name of variety.	Date of sowings.	Area sown in square yards.	Destroyed by root-rot in square yards.	Area picked.	Dates of pickings.	Actual outturn of area sown in			Outturn per acre on the area sown.			Outturn per acre on the area harvested in			Remarks.
								Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
J	Toria	Khanna ...	12th April 1920 ...	1,828	450	1,378	Pickings in case of Desi Cotton: 9 times—on 7th October 1920, 10th October 1920, 28th October 1920, 7th November 1920, 16th November 1920, 28th November 1920, 10th December 1920, 26th December 1920, 8th January 1921. Pickings in case of American Cotton: 7 times—on 16th October 1920, 29th October 1920, 7th November 1920, 8th November 1920, 29th November 1920, 10th December 1920, 26th December 1920.	3	11	0	8	26	14	11	20	2	In case of area J, the stubbles broken with the Rajah plough on 18th January 1920. S.T. harrow 6 times, Horse hoe once, Desi plough 4 times, Sohags 6 times. Applied 4 waterings on 28th June 1920, 27th July 1920, 9th August 1920, 4th September 1920. Dry hoeing with Bar harrow on 28th May 1920, Bar harrow once on 13th June 1920, Horse hoes, Lyallpur hoe on 30th June 1920, 14th July 1920, 31st July 1920, 12th August 1920.
	Do.	285-F ...	Ditto ...	1,828	373	1,455		1	12	0	3	17	11	4	12	15	
	Do.	22 Mollisoni ...	Ditto ...	1,828	371	1,457		2	33	6	7	20	3	9	16	10	
	Do.	280-F ...	Ditto ...	1,828	295	1,533		1	4	0	2	26	8	3	18	15	
	Do.	40 Rosea ...	Ditto ...	1,828	827	1,001		3	7	0	8	16	4	15	14	1	
	Do.	4-F ...	Ditto ...	1,823	404	1,424		1	0	8	2	27	4	3	17	10	
K	Toria	Khanna ...	Ditto ...	1,828	822	1,006		3	23	12	9	33	14	17	35	10	In case of area K, the stubbles broken with the Rajah plough on 28th December 1919, S.T. Harrow 5 times, desi plough 4 times horse hoe once. Dry hoeing with Bar harrow on 28th May 1920, again Bar harrow twice on 13th June 1920. Horse hoe, Lyallpur hoe on 1st, 14th and 31st July 1920. Four waterings on 28th June 1920, 27th July 1920, 22nd August 1920, 4th September 1920.
	Do	285-F ...	Ditto ...	1,828	413	1,415		1	21	4	4	2	3	5	9	8	
	Do.	22 Mollisoni ...	Ditto ...	1,828	295	1,533		3	3	2	8	6	0	9	28	12	
	Do.	280-F ...	Ditto ...	1,828	218	1,610		1	5	4	2	39	13	3	16	0	
	Do.	40 Rosea ...	Ditto ...	1,828	372	1,456		3	19	0	9	8	0	11	22	1	
	Do.	4-F ...	Ditto ...	1,828	460	1,368		1	18	4	3	34	3	5	6	2	

Statement No. 2.

STATEMENT SHOWING THE RESULT OF SPACING EXPERIMENT WITH 4-F AMERICAN COTTON TESTED IN KHARIF 1920 AT THE SARGODHA SEED FARM.

No. of field.	Previous crop.	Name of variety.	Date of sowing.	Area sown in square yards.	Destroyed by root-rot in square yards.	Area picked.	Dates of pickings.	Actual outturn of area sown in— Maunds.	Seers.	Chataks.	Outturn per acre on the area sown Maunds.	Seers.	Chataks.	Outturn per acre on the area harvested. Maunds.	Seers.	Chataks.	Remarks.
H	...	4-F lines 3 ft. apart.	24th April 1920.	3,953	951	3,002	Pickings 8 times on 16th October 1920, 29th October 1920, 8th November 1920, 18th November 1920, 28th November 1920, 11th December 1920, 25th December 1920, 7th January 1921.	5	21	2	6	30	12	8	36	8	In case of area H. the stubbles broken with the Rajah plough on 20th January 1920, S. T. harrow 6 times, desi plough 4 times horse hoe once, Sohaga 4 times, Dry hoeing with bar harrow 28th May 1920, again Bar harrow on 18th June 1920, Horse hoe on 14th July 1920, 19th July 1920, 1st August 1920, 13th August 1920. Waterings:— In case of area I, the stubble broken with the Rajah ploagh on 22nd January 1920, S. T. harrow 5 times, horse hoe 1, desi plough 5 times, Sohaga 6 times, Dry hoeing with Bar harrow on 23rd May 1920, again bar harrow on 13th June 1920, horse hoe on 14th July 1920, 15th July 1920, 1st August 1920, 13th August 1920.
H	...	4-F lines 4 ft. apart.	Ditto	3,833	1,047	2,786		3	11	6	4	5	14	5	2	4	
H	...	4-F lines 5 ft. apart.	Ditto	4,192	1,771	2,421		3	19	14	4	1	8	6	39	10	
I	...	4-F lines 3 ft. apart.	Ditto	3,953	1,373	2,580		2	29	14	3	14	8	5	6	2	
I	...	4-F lines 4 ft. apart.	Ditto	3,833	830	3,003		2	24	3	3	11	9	4	7	15	
I	...	4-F lines 5 ft. apart.	Ditto	4,192	1,013	2,179		3	34	12	4	18	11	5	35	10	

Statement No. 3.

WATER SOWING EXPERIMENT WITH TORIA TRIED AT THE SARGODHA SEED FARM DURING 1920-21.

No. of field.	Previous crop.	Date of sowing.	Date of Harvesting.	No. of waterings after sowing with dates.	Actual area in square yards.	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Stalks. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Stalks. Maunds.	Seers.	Chataks.	Remarks.
E	Wheat types	23rd September 1920.	1st—4th February 1921.	No ...	2,036 2/9	2	38	8	4	26	...	7	1	11	11	2	2	Land exceptionally rich.
Do.	Ditto	Ditto	Ditto	1 27th November 1920.	2,036 2/9	2	...	...	4	2	...	4	30	2	9	20	5	
Do.	Ditto	Ditto	Ditto	2 9th—27th November 1920.	2,036 2/9	2	28	...	4	10	...	6	16	11	10	4	1	
Do.	Ditto	Ditto	Ditto	No ...	2,036 2/9	1	8	...	2	5	...	2	34	1	5	2	1	
Do.	Ditto	Ditto	Ditto	1 27th November 1920.	2,036 2/9	2	31	...	4	30	...	6	23	13	11	11	10	
Do.	Ditto	Ditto	Ditto	2 9th—27th November 1920.	2,036 2/9	3	32	...	5	20	...	9	1	5	13	2	15	In case of area E, the stubbles broken with Rajah plough on 19th May 1921, S. T. harrow 6 times, desi plough 3, times, horse hoe 2 times, Sohaga 2 times.
F.	Ditto	Ditto	Ditto	No ...	2,036 2/9	1	2	...	2	...	...	2	19	13	4	30	2	
Do.	Ditto	Ditto	Ditto	1 27th November 1920.	2,036 2/9	3	5	...	5	...	...	7	17	2	11	35	6	In case of area F, the stubbles broken with Rajah plough on 2nd June 1920, S. T. harrow times, desi plough 3 times, horse hoe 2 times, Sohaga 2 times.
Do.	Ditto	Ditto	Ditto	2 9th—27th November 1920.	2,036 2/9	3	35	8	5	10	...	9	2	10	12	19	3	
Do.	Ditto	Ditto	Ditto	No ...	2,036 2/9	3	6	...	5	15	...	7	19	8	12	31	7	
Do.	Ditto	Ditto	Ditto	1 27th November 1920.	2,036 2/9	3	18	...	5	10	...	8	8	...	12	19	3	
Do.	Ditto	Ditto	Ditto	2 9th—27th November 1920.	2,036 2/9	4	6	...	5	30	...	9	34	9	13	26	11	

W

Statement No. 4.

STATEMENT SHOWING THE COMPARATIVE TEST OF DIFFERENT WHEAT TYPES TRIED AT THE SARGODHA SEED FARM DURING RABI 1920-21.

No. of field.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Remarks.
A. B. C.	Wheat types.	8-A ...	27th October 1920.	18th April 1921.	2,380	6	13	0	13	35	0	12	34	8	28	8	10	The stubbles broken with the Rajah plough on 18th May 1920, spring toothed harrow 4 times, horse hoe two times, desi plough 5 times, sohaga 6 times, chain harrow on 27th October 1920, Bar harrow two times once on 2nd December 1920, second on 7th January 1921. Applied three waterings on 29th December 1920, 5th February 1921, 20th March 1921.
		Punjab 14	Ditto ...	13th April 1921.	2,380	2	31	0	6	30	0	5	25	12	13	29	1	
		8-A ...	Ditto ...	18th April 1921.	2,380	1	10	0	4	0	0	2	21	11	8	5	9	
		Punjab 11	Ditto ...	15th April 1921.	2,380	2	29	0	7	15	0	5	21	11	14	39	15	
		8-A ...	Ditto ...	18th April 1921.	2,380	3	5	8	6	29	8	6	15	3	13	28	1	
		17-B ...	Ditto ...	15th April 1921.	2,380	5	29	8	12	28	8	11	26	11	25	34	1	
		8-A ...	Ditto ...	18th April 1921.	2,380	7	24	8	11	10	8	15	19	4	22	36	2	
		Busa 12	Ditto ...	15th April 1921.	2,380	6	16	8	13	14	8	13	1	10	27	6	15	
		8-A ...	Ditto ...	18th April 1921.	2,380	9	20	0	16	30	0	19	12	12	34	2	8	
		8-B ...	Ditto ...	15th April 1921.	2,380	6	7	0	15	8	0	12	22	5	30	36	7	
		8-A ...	Ditto ...	18th April 1921.	2,380	7	12	0	11	38	0	14	33	13	24	12	1	
		9-C ...	Ditto ...	15th April 1921.	2,380	5	35	8	11	39	8	11	38	15	24	15	2	
		8-A ...	Ditto ...	18th April 1921.	2,380	5	19	0	11	6	0	11	5	6	22	27	0	
		13-C ...	Ditto ...	15th April 1921.	2,380	3	8	8	11	10	8	6	21	5	22	36	2	
		8-A ...	Ditto ...	18th April 1921.	2,380	6	17	8	12	37	8	13	3	10	26	12	6	

Statement No. 5.

STATEMENT SHOWING THE COMPARATIVE TEST OF 8-B, PUSA 12, No. 11, AND 8-A WHEATS TRIED AT THE SARGODHA SEED FARM DURING RABI 1920-21.

No. of field.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Remarks.
L ...	Cotton	8-B ...	17th November 1920.	20th and 23rd April 1921.	2,606⅔	6	25	0	12	5	0	12	12	1	22	20	9	The stubbles broken with the Rajah plough on 20th February 1920. S. T. harrow 6 times, desi plough 4 times, horse hoe two times, sohaga 5 times. Four waterings after sowing on 22nd January 1921, 4th March 1921, 20th March 1921, 3rd April 1921, Bar harrow twice to all the plots on 31st January 1921, 1st February 1921, again twice on 12th February 1921.
		Pusa 12	Ditto ...	Ditto ...	2,606⅔	7	19	0	8	20	0	13	35	3	15	31	5	
		No. 11 ...	Ditto ...	Ditto ...	2,606⅔	10	26	0	8	20	0	19	31	0	15	31	5	
		8-A ...	Ditto ...	Ditto ...	2,606⅔	9	2	8	12	30	0	16	33	3	23	26	15	

Statement No. 6.

STATEMENT SHOWING THE COMPARATIVE TEST OF 8-A, No. 11, PUSA 12 AND 8-B WHEATS TRIED AT THE SARGODHA SEED FARM DURING RABI 1920-21.

No. of field.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Remarks.
M.	Cotton ...	8-A. ...	17th November 1920	20th-23rd April 1921.	2,606⅔	10	16	8	12	20	0	19	13	6	23	8	6	The stubbles broken with the English plough on 20th February 1920. S. T. harrow 6 times, desi plough 4 times, horse hoe 2 times, Sohaga 5 times. Four waterings after sowing on 22nd January 1921, 4th March 1921, 30th March 1921, 3rd April 1921. Bar harrow twice to all the plots on 31st January 1921, 1st February 1921, again twice on 12th February 1921.
	Ditto ...	No. 11 ...	Ditto	Ditto	2,606⅔	8	28	8	10	20	0	16	7	1	19	19	14	
	Ditto ...	Pusa 12 ...	Ditto	Ditto	2,606⅔	5	2	8	8	10	0	9	16	0	15	12	12	
	Ditto ...	8-B. ...	Ditto	Ditto	2,606⅔	5	31	0	29	15	0	10	28	15	37	33	4	

Statement No. 7.

WATER SAVING EXPERIMENT WITH WHEAT DURING RABI 1920-21 (COMPARISON BETWEEN NUMBER ONE, TWO AND THREE WATERINGS AFTER SOWING.)

No. of field.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Number of waterings after sowing with dates.	Actual outturn. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Grain. Chataks.	Bhusa. Maunds.	Bhusa. Seers.	Bhusa. Chataks.	Remarks.
N.	Cotton ...	Pusa 12...	8th December 1920.	25th April 1921.	2,289½	Three on— 22nd January 4th March 1921 20th March 1921	3	9	0	4	12	0	6	32	12	9	3	10	The stubbles broken with the Rajah plough on 24th February 1920. S. T. harrow 6 times, desi plough 4 times, horse hoe 2 times, Sohaga 4 times, chari harrow once in all the different plots after sowing.
	Ditto ...	Ditto ...	Ditto	Ditto	2,289½	Two on— 5th February 1921. 4th March 1921	1	17	0	2	30	0	3	0	8	5	32	9	(1) Bar harrow twice on 30th January 1920. Brand ford weeder twice on 8th March 1921, in case of 3 waterings. (2) Bar harrow once on 31st January 1921, again twice on 12th February 1921. Brand ford weeder twice on 8th March 1921, in case of 2 waterings. (3) Bar harrow once on 31st January 1921. Brand ford weeder twice on 8th March 1921, in case of one watering. (4) Bar harrow once on 31st January 1921, in case of one watering.
	Ditto ...	Ditto ...	Ditto	Ditto	2,289½	One on— 4th March 1921	1	8	0	3	0	0	2	21	8	6	13	11	
	Ditto ...	Ditto ...	Ditto	Ditto	2,289½	No ...	0	10	0	0	15	0	0	21	2	0	31	11	

Statement No. 8.

WATER SAVING EXPERIMENT WITH WHEAT DURING RABI 1920-21 (COMPARISON BETWEEN NUMBERS ONE, TWO AND THREE WATERINGS AFTER SOWING).

No. of field.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Number of waterings after sowing, with dates.	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Remarks.
O.	Cotton ...	Pusa 12 ...	8th December 1920.	25th April 1921	2,289⅓	Three— 30th January 1921. 4th March 1921. 20th March 1921.	5	18	0	8	0	0	11	20	14	16	36	8	Bar harrow twice on 30th January 1921. Brandford weeder thrice on 8th March 1921.
	Ditto ...	Ditto ...	Ditto	Ditto	2,289⅓	Two— 5th February 1921. 4th March 1921.	1	23	0	3	6	0	3	13	3	6	26	6	Bar harrow once on 30th January 1921. Brandford weeder thrice on 8th March 1921. Bar harrow again on 12th February 1921.
	Ditto ...	Ditto ...	Ditto	Ditto	2,289⅓	One— 4th March 1921.	1	23	0	2	4	0	3	13	3	4	17	9	Bar harrow once on 31st January 1921. Brandford weeder thrice on 8th March 1921.
	Ditto ...	Ditto ...	Ditto	Ditto	2,289⅓	No	0	11	0	0	33	0	0	23	4	2	0	5	Bar harrow once on 31st January 1921.

The stubbles broken with the Rajah ploughs on 24th February 1920, S.T. harrow 6 times, desi plough 4 times, Horse hoe 2 times, Sohagra 4 times, chain harrow once in all the different plots after sowing.

Statement No. 9.

COMPARATIVE TEST OF N. $H._{53}$ × $P._4$ AND N. $H._{98}$ × $P._4$ WHEAT TREED AT THE SARGODHA SEED FARM DURING RABI 1920-21.

No. of field.	Previous crop.	Name of type sown.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Outturn per acre. Grain. Maunds.	Seers.	Chataks.	Bhusa. Maunds.	Seers.	Chataks.	Remarks.
718/49-A.	Cotton ...	N. $H._{53}$ × $P._4$	26th October 1920 ...	10th April 1921 ...	2,470⅔	6	25	0	15	25	0	12	39	2	30	24	6	Rajah plough once— 4
																		Desi plough 1
																		S. T. harrow 3
																		Sohaga 3
																		Waterings 2
708/49-A.	Do. ...	N. $H._{98}$ × $P._4$	Ditto ...	Ditto ...	2,470⅔	6	36	0	17	34	0	13	20	10	34	33	11	Bar harrow ...

Statement No. 10.

STATEMENT SHOWING THE RESULTS OF ECONOMIC BOTANIST'S DIFFERENT GRAM VARIETIES TESTED AT THE SARGODHA SEED FARM DURING RABI 1920-21.

No. of fields.	Previous crop.	Name of type.	Date of sowing.	Date of harvesting.	Area sown in square yards.	Actual outturn.						Outturn per acre on the area sown.						Area harvested in square yards.	Outturn per acre on the area harvested.						Remarks.
						Grain.			*Bhusa.*			*Grain.*			*Bhusa.*				*Grain.*			*Bhusa.*			
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.		Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
P	Cotton ...	Local ...	27th September 1920	29th March 1921 ...	766⅔	0	13	8	1	0	0	2	5	4	6	12	8	405⅓	4	1	3	11	37	10	Stubbles broken with the Rajah plough on the 25th February 1920. S. T. harrow 4 times; desi plough 6 times; horse hoe 2 times; sohaga 4 times.
	Do. ...	E. B.-7 ...	Ditto ...	Ditto ..	766⅔	0	35	8	2	10	0	5	24	2	14	8	3	544⅔	7	35	9	20	0	1	
	Do. ...	Local ...	Ditto ...	Ditto ...	766⅔	0	15	0	1	0	0	2	14	11	6	12	8	408⅔	4	17	9	11	33	8	
	Do. ...	E. B.-15 ...	Ditto ...	Ditto ...	766⅔	0	8	12	0	30	0	1	15	4	4	29	6	400	2	25	14	9	3	0	
	Do. ...	Local ...	Ditto ...	Ditto ...	766⅔	0	19	8	1	10	0	3	3	2	7	35	10	629⅓	3	29	15	9	24	9	
	Do. ...	E. B -17 ...	Ditto ...	Ditto ...	766⅔	0	9	8	0	32	0	1	19	15	5	2	0	373⅓	3	3	3	10	14	14	
	Do. ...	Local ...	Ditto ...	Ditto ...	766⅔	0	16	8	0	35	0	2	24	3	5	20	15	426⅔	4	27	3	9	37	1	
	Do. ...	E. B.-20 ...	Ditto ...	Ditto ...	766⅔	0	17	8	0	37	0	2	30	8	5	33	9	512	4	5	7	8	29	12	

Statement No. 11.

STATEMENT SHOWING THE COMPARATIVE TEST OF LOCAL AND FRENCH OATS TRIED AT THE SARGODHA SEED FARM DURING RABI 1920-21.

No. of field.	Previous crop.	Name of variety.	Date of sowing.	Date of harvesting.	Actual area in square yards.	Actual outturn.						Outturn per acre.						Remarks.
						Grain.			*Straw.*			*Grain.*			*Straw.*			
						Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.	
Q ...	Wheat types...	Local ...	10th October 1921 ...	25th March 1921...	1,330⅓	1	22	0	3	10	0	5	25	1	11	31	4	The stubbles broken with the Rajah plough on 13th May 1920. S. T. harrow 4 times, desi plough 5 times, horse hoe twice, sohaga 6 times, 2 waterings on 29th December 1920 and 4th March 1921, applied to both the varieties, and to French oats applied one more watering on 3rd April 1921. Bar harrow twice on 7th January 1921.
Q ...	Ditto ...	French ...	Ditto ...	15th May 1921 ...	655⅚	...	...	...	2	20	0	...	...	...	18	18	5	
R ...	Ditto ...	Do. ...	Ditto ...	Ditto ...	655⅚	...	...	...	2	30	0	...	...	...	20	12	2	
R ...	Ditto ...	Local ...	Ditto ...	25th March 1921...	1,333⅓	2	27	0	5	20	0	9	28	7	19	38	10	
S ...	Ditto ...	Do. ...	Ditto ...	Ditto ...	1,333⅓	1	30	0	3	20	0	6	14	2	12	28	3	
S ...	Ditto ...	French ...	Ditto ...	15th May 1921 ...	1,000	...	...	...	3	30	0	...	...	...	18	6	0	
T ...	Ditto ...	Do. ...	Ditto ...	Ditto ...	533⅓	...	...	...	1	20	0	...	...	...	13	24	8	
T ...	Ditto ...	Local ...	Ditto ...	25th March 921...	586⅔	0	30	0	1	25	0	6	7	8	13	16	4	
T ...	Ditto ...	Do. ...	Ditto ...	Ditto ...	586⅔	0	39	0	1	30	0	7	0	8	14	17	8	
T ...	Ditto ...	French ...	Ditto ...	15th May 1921 ...	533⅓	...	...	...	1	10	0	...	...	...	11	13	12	

Annual Report on the experiments at the Hansi Agricultural Station, by Sardar Darshan Singh of Vahali, I.A.S., Deputy Director of Agriculture, Punjab, for the year ending 30th June 1921.

Introductory —The Farm was started with the chief object of improving the quality of cotton grown in the surrounding tract (see page 4, paragraph 10 of Mr. Hamilton's Annual Report of 1913). It was mentioned in my last year's report that a selection of the Desi cotton which had invariably given the highest profits per acre from amongst the Desi cottons for over a number of years had been obtained, and that it competed very favourably in profits with the best of the Americans in this part of the province. I am glad to add that this year I was able to give out over 1,000 maund seed of this selection, though the demand for it was so immense that 5 times the amount would not have been sufficient to meet the requirements of the zamindars, who all seemed to be very pleased with it and speak very highly of it.

S. Milligan, Esquire, Agricultural Advisor to Government of India, who paid a visit to Hansi Farm on 13th October 1920, at the time of the fruiting of cottons, considered this selection to be very promising, and likely to improve the quality of the cotton of surrounding country.

Selection No. 74 is the heaviest yielder with a high percentage of lint, and with the best valuation among the Desi cottons (see statement No. 2).

In my last year's report I dwelt on the importance of producing enough pure seed of this variety for distribution in the tract. With this point in view I approached the Government for sanctioning a ginning installation and extending the area of the Farm for multiplying the seed under the direct Departmental supervision. The ginning installation has been sanctioned but not yet completed, the proposal for the extension of Farm area has also been submitted These two things done, the work will get on very much *more* rapidly.

Season and its effect.—The total rainfall at the Hansi Agricultural Station during the year under report has been 5·78″ (*vide* statement No. 1). Out of this 4·7″ was received in the month of July, while during the rest of the 11 months the rainfall was 1·08″ only. This rainfall, which is extremely insufficient, and was distributed in light showers, which could not be utilised for agricultural purposes, and were merely sprinklings. The year under report was therefore extremely unfavourable for agriculture, and no barani crops could be expected. Kharif did not receive any appreciable rain after its sowing, while barani rabi could not be sown at all. The canal irrigated crops also suffered very considerably. The canal supply was extremely irregular and insufficient, and our water-course ran only for about 4 to 5 days in a month during the greater part of the year. It was under such conditions that our experiments of this your had to be conducted, and I need hardly add that it was not an easy matter to obtain good and useful results in such an abnormal season. In fact, it was a very anxious time, and a hard question to decide from time to time which experiments to sacrifice and which to keep. The difficulty was more keenly felt as our farm land is uneven in nature, having big saline patches, and owing to the abnormally dry season the effect of kallar was more manifest, as in the years of good rainfall or ample water supply this is washed down to the lower stratum. The fodder question presented further difficulties as, owing to the insufficiency of canal water, only very limited area could be sown with fodder and the situation could not be improved, unless we were prepared to forego our cotton experiments ; this we could not afford to do, and thus for the first time in the history of the farm, fodder had to be purchased. The ensilage experiment had also to be given up.

Effect on cottons.—On account of dryness of season and low humidity there was shedding of flowers and buds among cottons. Formation of bolls was comparatively early, but the size reduced, and the lint percentage was also lower as compared with normal years.

Effect on wheats.—The wheats were given only two waterings, and the dry western winds in March caused the grain to shrivel and did not give it a chance of developing and ripening properly.

Effect on sugarcane.—This crop suffered from continuous drought. Its growth was stunted and the quality of Gur was inferior.

Toria could not be irrigated at all after sowing.

Cottons.—Forty-five acres of cotton including two acres of Barani cotton were sown at the farm under various experiments.

Series No. 1 Varietal test.—Five different American varieties, *i.e.*, 280-F.,* 175-F., 161-A.F., 4-F. and Narma of Pasina Kalan and 8 Desi varieties, *i.e.* White Flowered Neglectum Bhatla Selected No. 74, Neglectum Yellow Flowered Bhatla Selected Indicum white flowered, Bhatla S., Local Bhatla, Mollisonea 24, Rosea 132, and Rosea 87, were tried against white flowered Neglectum Bhatla Selected, which was used as standard.

As last year, among the Desi cotton varieties Neglectum white flowered Bhatla S. No. 74 has given the highest yield, while among the Americans, 280-F. has done best (for full particulars see statements Nos. 3 & 4).

Series No. 2 Spacing experiment with cottons.—These were tried with 4-F. American and (2) white flowered Indicum Bh. S. The spacings were the same as in previous years, *i.e.*, 4′, 3½′, 3′, and 2½′ for the Americans and 2′½, 2, and 1½′ for Desis. The experiments were tried in duplicate. The average yield per acre is as follows :—

4-F. American cotton.

Spacing.	*Average yield per acre.*		
	Mds.	Srs.	Ch.
4 ft.	5	18	0
3½ „	6	12	15
3 „	6	8	8
2½ „	5	23	8
White Flowered ; Indicum Bhatla. S.			
2½ ft.	6	3	13
2 „	5	2	1
1½ „	4	16	7

(see statements Nos. 5 and 6.)

This confirms our previous year's experience that 3 to 3½ feet is the best distance for the American cottons.

SERIES No. 3.

(*a*) *Broad casting* versus *sowing in lines.*—Four hoeings with kasola were given to both the plots. The broad casted has given the greater yield and this is our experience for the past years as well. Of course in this experiment the same number of hoeings has been given to both the plots with Kasola (hand labour) to keep uniform conditions, but line sown cotton could be hoed very much more cheaply with bullock-driven implements, and this is where the ultimate economic difference comes in.

	Outturn per acre.		
	Mds.	Srs.	Ch,
Broad casted	7	29	14
Line sown	7	12	8

(See statement No. 7.)

(*b*) *Different number of hoeings to broad casted cotton.*—2, 3 and 4 hoeings were given with kasola to the broad casted cotton. The plot which received four hoeings has given the greater yield than the one which received three hoeings only, while the plot which received two hoeings cannot, I am afraid, be taken in to consideration on account of its peculiar nature and better fertility.

	Outturn per acre.		
	Mds.	Srs.	Ch.
3 hoeings with kasola	6	27	8
4 hoeings with kasola	7	29	14

(For full detail see statement No. 8.)

(*c*) *Same number of hoeings to cotton in lines but with different kinds of hoes.*—Three hoeings were given to line sown cotton with kasola, country plough, horse hoe and Gujrat hoe.

(For full particulars see statement No. 9.)

SERIES No. 4.

Deep and shallow ploughing as preparation for cotton sowing.—Three acre fields were prepared with country plough, Rajah plough and sabul plough respectively.

The deeper ploughing has increased the yield of cotton. The highest yield was received from the plot prepared with sabul plough.

	Outturn per acre.		
	Mds.	Srs.	Ch.
Country plough	6	3	1
Rajah „	6	0	1
Sabul „	7	37	5

(statement No. 10.)

N.B. The experiments of series Nos. 3 and 4 were carried out in plots No. 1 to 10 of Block D. The soil of this block is very uneven owing to big saline patches ; and as already mentioned under " Season and its effect " the effect of unevenness was more marked this year than in normal years.

Experiment with early and late sown American and Desi cottons.—4F. American and white Flowered ; Neglectum Bhatla S were tried side by side to see which variety would yield better if sown late. In case of late sowings different seed rates were tried to see if heavier seed rate can, to any extent, counterbalance the effect of lateness. The results in all cases are in favour of Neglectum white Flowered ; Bhatla S.

Variety.	Early sown.	Late sown (6 seers seed rate.)	Late sown (10 seers seed rate.
	Mds. S. C.	Mds. S. C.	Mds. S. C.
4 F.	3 39 6	3 18 15	4 15 11
Neglectum Wht. Fld. Bh.S.	5 14 6	6 20 6	6 17 11

It is interesting to note that the late sown crop has given the better yield in most cases and this result is at variance to our previous year's experience. The difference, I think, is due to the dryness of season, the earlier sown crop utilising most of the moisture in vegetative growth, while the late sown used it for producing fruit.

(See statement No. 11.)

Experiment to see water reqirements of cottons.—The object of this experiment was to see the most suitable number of waterings for cotton, and to find out how far the hoeing of cotton can save the number of waterings. This was tried with one American and two Desi varieties, namely 4-F. American, white Flowered ; Neglectum ; Bhatla S and white Flowered ; Indicum Bhatla S.

This experiment is a very good demonstration to a cultivator who does not take the trouble of hoeing his cotton properly, and makes this up, to his thinking, in greater number of waterings.

In this experiment we are trying 5 waterings and one hoeing, 4 waterings and 2 hoeings and so on, up to one watering and 5 hoeings. It will be seen from this as well as from last year's results that the best yields are obtained with about three waterings and three to four hoeings, while greater number of waterings with less hoeings have invariably resulted in a decrease of yield.

(See statement No. 12.)

Manurial experiment with cotton.

(1) *Use of cotton sticks.*—The object of this experiment is to make manurial use of cotton sticks instead of allowing them to stand in land after the crop is over.

(*a*) Application of ashes of burnt cotton sticks.

(*b*) Removing and rotting cotton sticks and applying organic matter.

(*c*) Removing cotton sticks after last picking.

(*d*) Leaving cotton sticks for a long time and removing them before sowing the following crop, which is the common practice of the cultivator.

The results of this experiment are not reliable on account of water being not available for all the plots at one time, and also owing to the unevenness of the soil.

(2) Ten lbs, of nitrogen per acre in the form of sodium nitrate and potassium nitrate are being applied in conjunction with farm yard manure. The results are unreliable for the same reason as above.

PERMANENT COTTON PLOT.

An experiment to see how far growing cotton after cotton on the same land every year without returning anything to the soil affects its fertility was started in 1915. The results are interesting, as they show gradual decrease in yield every year. The yield of the present year is 2 maunds and 38 seers, though there may be other factors this year effecting the yield.

1915.	1916.	1917.	1918.	1919.	1920.
Mds. S. C.	*Mds. S. C.*	*Mds. S. C.*	*Mds. S. C.*	*Mds. S. C.*	*Mds. S. C.*
11 22 0	10 9 0	1 30 1	7 26 9	5 8 5	2 38 0

(Crop destroyed by excessive rain.)

Miscellaneous experiments with cottons.

Thinning experiment.—This is being carried out on the lines of previous year. No results are available owing to the abnormal conditions.

Barani cotton.—Two acres were grown with the Local Bhatla mixture as a barani crop. Out of these half of one was treated with sand and the yield from this treated plot was 1 maund 3 seers 1 chatak per acre, while the untreated half yielded at the rate of 25 seers 11 chataks per acre.

The yield of the other field was 34 seers 5 chataks per acre.

We are also carrying an environment experiment with cotton for the Economic Botanist, Punjab.

A parasite breeding plot was also kept for the Professor of Entomology as usual.

Plant selection of desi cottons.

I have already given in my last year's report a short history of the work done on the selection of desi cottons, and there is little need to repeat it over again. The work is being carried on the same lines, and plants giving a ginning percentage of 39 to 45·6 % have only been selected during the last Kharif.

As mentioned already much useful work has been done in this direction, and we have already got a type No. 74 which has done best in yield and has been valued at a higher price among the desi cottons by Karachi Chamber of Commerce, and has brought more money per acre than any other variety grown at the farm this year (see statement No. 2).

I, however, expect to bring out a type that would give even better results than No. 74 in all respects, *i e*, yield, lint percentage and fineness.

The work is very heavy and requires lot of labour, and, as suggested by Agricultural Advisor to Government of India, we should have a special man put on this work alone as the results expected are very promising and this tract with its present limited supply of water and various other conditions is better suited to Desi cotton than American.

Combodia cotton, being a late ripening crop, gave practically no yield at the farm for a couple of years, but now certain early ripening plants have been selected, and I have sufficient seed of these plants to try them on fieldscale.

Wheats.

Eighteen acres of wheat were grown this year under our direct cultivation and 12½ acres with tenants. No barani wheat could be sown this year.

Varietal test of wheats.

Ten varieties of wheat, *i.e.*, 8-A, 8-B, 9-C, 17-B, 20-C, Pb-11 Pb-17, Pusa-12, 16-A and Federation wheat were tested against Pb. 14 as standard. The varieties were sown in duplicate on an area of $\frac{2}{12}$ acre each. 8-A has again topped the list, giving an increase of mds. 3-2-4 per acre above the standard, while 16-A comes next, giving an increase of mds. 2-15-½ : Pb.-11 follows with mds. 1-18-6½.

16-A and Federation wheat were tried for the first time at the Farm. The 16-A seems a promising type. The average yield per acre of all the types is as follows :—

Name of variety.	Average yield per acre.			Average yield per acre in terms of standard.			Increase or decrease as compared with standard.		
	Mds.	S.	C.	Mds.	S.	C.	Mds.	S.	C.
8-A	21	0	0	17	37	12	+ 3	2	4
16-A	21	3	9	18	28	8½	+ 2	15	½
Punjab-11	17	1	11½	15	23	5½	+ 1	18	6½
Punjab-14	16	16	13	16	16	13		*Nil*	
9-C	19	8	0	19	38	8½	− 0	30	8½
20-C	14	19	13	15	11	4	− 0	31	7
Punjab-17	13	13	6	14	6	15½	− 0	33	9½
Pusa-12	13	34	4	12	35	14	+ 0	38	6
Federation wheat	12	7	8	14	32	8	− 2	25	0
8-B	15	36	0	19	21	8	− 3	15	8
17-B	11	16	5	15	37	8½	− 4	21	8½

SOWING OF WHEAT BY VARIOUS METHODS.

Wheat 8-A (like last year) was sown with Akola Drill, Lyallpur Drill, Poona Drill, New Drill, prepared by D. D. A., Hansi, Shallow nali with sohaga, country methods (sowing with pora and no sohaga) and country methods followed by sohaga just after the start of germination. The object of this experiment is to get a good germination and a level surface for interculture, weeding and reaping by machinery. Observations were made at the time of germination. The germination of plot sown with Hansi drill was by far the best, and this has also given the highest yield besides being the most economical drill to use both for time and labour.

Akola drill is the next best as regards germination and outturn, but it requires 4 men to sow 3 furrows at a time while the Hansi drill sows 5 furrows with only one man. The results are as follows :—

Name of drill.	*Outturn per acre.*		
	Mds.	S.	C.
Hansi Drill	12	25	8
Akola Drill	12	22	8
Lyallpur Drill	10	30	0
Shallow nali with sohaga	9	26	4
Poona Drill	9	8	8
Nali with sohaga	8	0	0
Nali and sohaga after germination	5	15	12

Deep and shallow cultivation for wheat and interculture experiments with wheat were carried on the lines of previous years, but the results are not reliable on account of abnormal dry conditions and the saline patches showing greater effect. In no case could that wheats be given more than two waterings and thus the saline patches were very prominent this year.

Permanent wheat plot.—This experiment of growing wheat after wheat in the same plot without adding any thing to the soil was started in 1913, to see how far this practice effects the fertility of the soil. While there is no doubt that there has been a gradual decrease in the yield, which was about half in 1919-20 to what it was in 1916 when this experiment was started, the results of the present year are misleading and the abrupt fall in yield is due to other factors. The results are as follows :—

		Mds.	S.	C.
Rabi	1916-17	30	20	0
„	1917-18	22	20	0
„	1918-19	19	10	0
„	1919-20	15	14	0
„	1920-21	0	23	4

Sugarcane.

Three acres of sugarcane were grown, and the following varieties were tested, *i.e.*, Jawa 105, Bihar, Suretha, Lalri, Mango, Dhaura and Local. The varieties were sown in duplicate, one set being treated with farm yard manure at the rate of 15 tons per acre, while the other set received 15 maunds of castor cake per acre in addition. The plots that received castor cake gave higher yields, though the very big increase in some cases is not merely due to the addition of castor cake. (See statement No. 14.)

Variety.	*Farm yard manure.*			*Farm yard manure and caster cake.*		
	Mds.	S.	C.	Mds.	S.	C.
Suretha ...	24	25	2	44	30	6
Local ...	23	27	4	24	4	9
Mango ...	20	16	7	28	31	3
Larli ...	16	32	13	42	21	4
Jawa 105 ...	12	25	1	29	1	0
Bihar ...	8	11	6	32	6	11

(Statements 14 and 15.)

Barley and Gram.

The same four varieties of barley received from Economic Botanist, Punjab, as tried last year, were again grown this year at the farm along with the local barley. Type No. 2 has this year done best (for full details see statement No. 16); 8 varieties of gram (4 from Economic Botanist, Punjab, and 4 from Burma) are being tried against the local variety. (See statement No. 17.)

Toria (Brassica Campestris).—This crop was sown in rotation with American cotton and wheat, but as it received no watering after sowing the results are poor.

Bajra (Pennisetum Typhoideum).—Both Australian a nd local bajra were tried. The Australian bajra yielded nothing on account of complete failure of rains, while the local bajra gave only a few seers.

Fodders.

Jowar.—We could only grow 15 acres of jowar this year and thus making of silage was not possible.

Japan Rape, senji, barseem, shaftal, lucerne, gowar, oats, barley, beet root and mangolds were also grown at the farm on a small scale.

Drought resisting grasses.—Teff and Rhodes grass were sown in the month of November. The germination was good, but the amount of fodder produced was not much on account of their stunted growth.

The seeds of other drought resisting grasses and fodder plants were not procurable anywhere, and consequently they could not be sown. The seeds of some of them have now, however, been received from Messrs. Sutton and Company.

Visitors.—The Farm was visited by many officials, cultivators of the districts of Hissar, Rohtak, Karnal, Ambala, Ferozepore, Gurgaon and Delhi province.

A party of Inspectors and Sub-Inspectors of Co-operative Credit Societies with the Assistant Registrar was received and given a short course of lectures and demonstration. Arrangements were made with the Deputy Commissioners and parties of Revenue Officers, and selected cultivators were received from various districts of my circle during the month of November. They were shown the various experiments that are being conducted at the Farm, and practical demonstrations of implements were given.

Students from Gurukul Kangri, and various classes from Lyallpur Agricultural College visited the Farm and were explained the experiments.

Implements.—Among the new implements tried at the Farm might be mentioned the Little Marvel plough and the Martin Ditcher and Grader. The Little Marvel plough is a lighter implement than the Rajah plough, and the cultivator is nearer the bullocks than is the case with Rajah plough. The Martin Ditcher and Grader is very useful for cleaning kacha farm roads and water-courses.

Statement No. 1

SHOWING THE RAINFALL DURING THE YEARS 1919-20 AND 1920-21 AT THE HANSI AGRICULTURAL STATION.

1	2	3	4
Name of month.	1919-20.	1920-21.	Remarks.
June	0·05	0·1	The rainfall during year excepting July was only 1·08".
July	4·17	4·7	
August	1·92	0·55	
September	0·84	*Nil*	
October	*Nil*	*Nil*	
November	*Nil*	*Nil*	
December	0·47	0·14	
January	0·24	0·04	
February	0·64	*Nil*	
March	1·10	*Nil*	
April	*Nil*	0·25	
May	0·85	*Nil*	
Total	10·28	5·78	

Statement No. 2

SHOWING THE VALUATION OF LINT OF COTTON VARIETIES PER ACRE GROWN AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1920 (BY THE KARACHI CHAMBER OF COMMERCE).

Serial No.	Name of variety.	Weight of cotton (kappas) per acre.			Weight of lint per acre.			Percentage of lint to cotton.	Value of lint per maund.	Net amount per acre.	Remarks.
		Maunds.	Seers.	Chataks.	Maunds.	Seers.	Chataks.				
									Rs. A. P.	Rs. A. P.	
1	White Fld. Neglectum Bh. S. ..	5	16	4	1	36	11	35·46	26 5 9	50 8 7	
2	„ „ „ 74 ...	6	33	13½	2	22	5	37·37	26 5 9	67 6 9	
3	„ „ Indicum Bh. S. ...	4	38	2	1	26	0	33·32	24 6 6	40 4 4	
4	Yellow Fld. Neglectum „ „ ...	4	0	14½	1	13	10	33·33	24 6 6	32 11 7	
5	„ „ Indicum „ „ ...	4	18	13½	1	9	1	28·21	23 14 8	29 5 4	
6	Rosea 132	3	23	12½	1	10	4	34·95	23 14 8	30 0 9	
7	„ 87	3	24	13½	1	5	13	31·65	26 5 9	30 3 0	
8	Mollisonea 24	3	21	6½	1	10	12	35·90	22 15 1	29 1 9	
9	4-F.	3	29	5½	1	8	4	32·32	25 6 1	30 9 10	
10	280-F.	4	29	9	1	16	9	29·85	28 4 11	40 0 5	
11	275-F.	3	16	10½	1	3	10	31·93	27 5 4	29 13 0	
12	161-A. F.	3	34	15	1	9	13	32·17	27 5 4	34 0 7	
13	Narma of Pasina Kalan ...	5	3	8	1	24	8	31·17	26 5 9	42 8 1	
14	Local Bhatla	3	18	7	1	3	9½	31·48	22 15 1	25 0 0	
15	Narma of Khojgipur	...	...	...	...	...	...	...	27 5 4	...	
16	285-F.	...	...	...	...	...	...	...	31 3 10	...	
17	Old Local Bhatla	...	...	...	...	...	...	...	17 9 2	...	

Statement No. 3

CONSOLIDATED STATEMENT OF VARIETAL TEST OF COTTONS AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1920.

Serial No.	Name of variety.	Average yield per acre.			Remarks.
		Maunds.	Seers.	Chataks.	
1	White Fld. Neglectum Bh. S.	5	16	4	
2	Neglectum Wht. Fld. No. 74	6	33	13½	
3	White Fld. Indicum Bh. S.	4	38	2	
4	Neglectum yellow Fld. Bh. S.	4	0	14½	
5	Indicum „ „ „ „	4	13	13½	
6	Rosea 132	3	23	12½	
7	„ 87	3	24	13½	
8	Mollisonea 24	3	21	6½	
9	4-F.	3	29	5½	
10	280-F.	4	29	9	
11	275-F.	3	16	10½	
12	161-A. F.	3	34	15	
13	Narma of Pasina Kalan	5	3	8	

Statement No. 4 (*a*)

SHOWING THE RESULTS OF VARIETAL TEST WITH COTTON CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1920.

Serial No.	Block and plot No.	Variety.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual Outturn. Maunds.	Actual Outturn. Seers.	Actual Outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Outturn per acre in terms of standard. Maunds.	Outturn per acre in terms of standard. Seers.	Outturn per acre in terms of standard. Chataks.	Remarks.
1	C / 14 *b*	White flowered Neglectum Bhatla S. ...	9,570 43,560	8,608 43,560	1st April 1920 ...	13th August 1920 ...	20th December 1920 ...	0	29	1	3	27	1	3	27	1	Ploughing ... 5 Harrowing ... 5 Sohaging ... 3 Hoeing ... 5 Watering ... 3
2	C / 14 *a*	White flowered Neglectum No. 74 ...	9,570 43,560	9,570 43,560	Ditto ...	Ditto ...	Ditto ...	1	8	13	5	22	3	4	39	0	
3	C / 15 *b*	Ditto Bhatla S. ...	9,570 43,560	8,494 43,560	Ditto ...	Ditto ...	Ditto ...	1	8	15	6	10	15	6	10	15	
4	C / 15 *a*	Indicum white flowered Bhatla S. ...	9,570 43,560	8,816 43,560	Ditto ...	Ditto ...	Ditto ...	0	34	14	4	12	5	5	15	4	
5	C / 16 *b*	White flowered Neglectum Bhatla S. ...	9,570 43,560	9,450 43,560	Ditto ...	Ditto ...	Ditto ...	1	1	2	4	29	9	4	29	9	
6	C / 16 *a*	Neglectum yellow flowered Bhatla S. ...	9,570 43,560	9,290 43,560	Ditto ...	Ditto ...	Ditto ...	0	32	7	3	32	2	5	8	15½	
7	C / 17 *b*	White flowered Neglectum Bhatla S. ...	9,570 43,560	8,980 43,560	Ditto ...	Ditto ...	Ditto ...	1	6	14	5	27	6	5	27	6	
8	C / 17 *a*	Indicum yellow flowered Bhatla S. ...	9,570 43,560	8,668 43,560	Ditto ...	Ditto ...	Ditto ...	0	54	7	4	13	1	6	0	10	
9	C / 18 *b*	White flowered Neglectum Bhatla S. ...	9,570 43,560	9,320 43,560	Ditto ...	Ditto ...	Ditto ...	1	14	5	6	13	14	6	13	14	
10	C / 18 *a*	Local Bhatla	9,570 43,560	9,212 43,560	Ditto ...	Ditto ...	Ditto ...	0	34	2	4	1	6	5	37	11	

11	C / 19 *b*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	7,706 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	39	3	5	21	8	5	21	8	
12	C / 19 *a*	Rosea 132	9,570 / 43,560	8,727 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	24	13	3	3	14	5	16	14	
13	C / 20 *b*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	8,890 / 43,560	31st March 1920 ...	Ditto ...	Ditto ...	1	3	5	5	12	4	5	12	4	
14	C / 20 *a*	Rosea 87	9,570 / 43,560	9,284 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	25	0	2	37	5	4	28	10	
15	C / 21 *b*	White flowered Neglectum Bhatla S.	9,570 / 43,560	9,470 / 43,560	Ditto ...	Ditto ...	Ditt ...	0	35	14	4	5	0	4	5	0	
16	C / 21 *a*	Mollisonea 24	9,570 / 43,560	9,212 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	30	10	3	24	13	5	15	5½	
17	C / 22 *b*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,365 / 43,560	Ditto ...	Ditto, ...	Ditto ...	1	17	2	6	25	11	6	25	11	
18	C / 22 *a*	4-F.	9,570 / 43,560	9,486 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	2	3	4	33	11	5	39	11½	
19	C / 23 *b*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,273 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	5	8	5	13	12	5	13	12	
20	C / 23 *a*	280-F.	9,570 / 43,560	9,366 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	11	6	5	38	15	5	3	13	
21	C / 24 *b*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,472 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	2	2	4	33	12	4	33	12	
22	C / 24 *a*	275-F.	9,570 / 43,560	9,290 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	5	15	5	15	6	5	28	½	
23	C / 25 *b*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,570 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	17	10	6	22	5	6	22	5	
24	C / 25 *a*	161-A. F.	9,570 / 43,560	9,500 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	15	4	6	13	5	8	22	½	
25	C / 26 *b*	Nazma of Pasina Kalan	9,570 / 43,560	9,104 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	38	7	4	23	15	8	22	½	
26	C / 26 *a*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	8,870 / 43,560	Ditto ...	Ditto ...	Ditto ...	2	5	14	10	21	12	10	21	12	

Statement No. 4 (*b*)

SHOWING THE RESULTS OF VARIETAL TEST WITH COTTON CONDUCTED AT HANSI AGRICULTURAL STATION DURING KHARIF 1920

Serial No.	Block and plot No.	Variety.	Area sown in acres.	Area harvested in acres.	Date of Sowing,	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Outturn per acre in terms of standard. Maunds.	Outturn per acre in terms of standard. Seers.	Outturn per acre in terms of standard. Chataks.	Remarks.
1	C 14 *e*	White flowered Neglectum Bhatla S. ...	9,570 43,560	9,102 43,560	1st April 1220 ...	13th September 1920...	20th December 1920 ...	0	19	12	2	14	8	2	14	8	Ploughing ... 5 Harrowing ... 5 Sohaging ... 3 Watering ... 3 Hoeing .. 5
2	C 14 *d*	Narma of Pasina Kalan	9,570 43,560	4,660 43,560	Ditto ...	Ditto ...	Ditto ...	0	23	13	5	23	1	3	21	10½	
3	C 15 *e*	White flowered Neglectum Bhatla S. ...	9,570 43,560	7,268 43,560	Ditto ...	Ditto ...	Ditto ...	0	27	8	4	4	13	4	4	13	
4	C 15 *d*	161-A. F.	9,570 43,560	7,940 43,560	Ditto ...	Ditto ..	Ditto ...	0	10	5	1	16	9	3	23	6½	
5	C 16 *c*	White flowered Neglectum Bhatla S. ...	9,570 43,560	6,136 43,560	Ditto ...	Ditto ...	Ditto ...	0	17	3	3	2	0	3	2	0	
6	C 16 *d*	275-F.	9,570 43,560	5,921 43,560	Ditto ...	Ditto ...	Ditto ...	0	7	14	1	17	15	4	6	1½	
7	C 17 *c*	White flowered Neglectum Bhatla S. ...	9,570 43,560	6,204 43,560	Ditto ...	Ditto ...	Ditto ...	0	29	15	5	10	3	5	10	3	
8	C 17 *d*	280-F.	9,570 43,560	6,701 43,560	Ditto ...	Ditto ...	Ditto ...	0	21	9	3	20	3	5	1	15½	
9	C 18 *c*	White flowered Neglectum Bhatla S. ...	9,570 49,560	7,617 43,560	Ditto ..	Ditto ...	Ditte ...	0	33	14	4	33	12	4	33	12	
10	C 18 *d*	4-F.	9,570 43,560	8,400 43,560	Ditto ...	Ditto ...	Ditto ...	0	20	4	2	25	0	4	38	0	

11	C / 19 *c*	White flowered Neglectum Bhatla S. ...	9,370 / 43,560	9,370 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	3	8	5	2	4	5	2	4
12	C / 19 *d*	Mollisonæ 24	9,570 / 43,560	9,428 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	29	14	3	18	0	6	8	4
13	C / 20 *c*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,067 / 43,560	31st March 1920 ...	Ditto ...	Ditto ...	1	21	4	7	14	4	7	14	4
14	C / 20 *d*	Rosea 87	9,570 / 43,560	9,444 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	37	6	4	12	6	5	10	14½
15	C / 21 *c*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,070 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	26	9	3	7	9	3	7	9
16	C / 21 *d*	Rosea 132	9,570 / 43,560	9,349 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	35	2	4	3	11	3	35	8
17	C / 22 *c*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,366 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	39	7	4	23	7	4	23	7
18	C / 22 *d*	Local Bhatla	9,570 / 43,560	9,478 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	25	2	2	35	8	6	27	5½
19	C / 23 *c*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	5,666 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	5	11	8	31	4	8	31	4
20	C / 23 *d*	Indicum yellow flowered Bhatla S. ...	9,570 / 43,560	8,732 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	35	0	4	14	10	7	2	9½
21	C / 24 *c*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,265 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	5	8	5	13	15	5	13	15
22	C / 24 *d*	Neglectum yellow flowered Bhatla S. ...	9,579 / 43,560	9,114 / 43,560	Ditto ...	Ditto ...	Ditto ...	0	35	8	4	9	11	5	9	5
23	C / 25 *c*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,178 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	3	2	5	4	11	5	4	11
24	C / 25 *d*	Indicum white flowered Bhatla S. ...	9,570 / 43,560	8,414 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	3	4	5	23	15	5	19	5
25	C / 26 *c*	White flowered Neglectum 74 ...	9,579 / 43,560	8,624 / 43,560	Ditto ...	Ditto ...	Ditto ...	1	24	7	8	5	8	5	19	5
26	C / 26 *d*	White flowered Neglectum Bhatla S. ...	9,570 / 43,560	9,438 / 3,4560	Ditto ...	Ditto ...	Ditto ...	1	10	11	5	33	15	5	33	15

Statement No. 5

SHOWING THE RESULTS OF SPACING EXPERIMENT WITH COTTON CONDUCTED AT HANSI AGRICULTURAL STATION DURING KHARIF 1920.

Serial No.	Block and plot No.	Name of variety.	Previous crop.	Area of sub-plot in acres.	Area harvested in acres.	Spacing.	Date of Sowing.	Date of First picking.	Date of Last Picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	A / 5 a	4-F Cotton ...	Toria ...	½	48/100	4 feet ...	26th March 1920 ...	15th September 1920	20th December 1920	2	19	11	5	7	11	Ploughing ... 4 Harrowing ... 4 Sohaging ... 4 Watering ... 8 Hoeing ... 5
2	A / 5 b	Do. ...	Do. ...	½	48/100	3½ feet ...	Ditto ...	Ditto	Ditto	3	7	14	6	26	6½	
3	A / 6 a	Do. ...	Do. ...	½	49/100	3 feet ...	Ditto ...	16th September 1920	Ditto	3	15	14	6	37	5	
4	A / 6 b	Do. ...	Do. ...	½	48/100	2½ feet ...	Ditto ...	15th September 1920	Ditto	3	10	10	6	32	2	
5	A / 7 a	Do. ...	Do. ...	½	48/100	4 feet ...	Ditto ...	Ditto	Ditto	2	29	9	5	23	4	
6	A / 7 b	Do. ...	Do. ...	½	49/100	3½ feet ...	Ditto ...	Ditto	Ditto	2	37	5	5	39	7	
7	A / 8 a	Do. ...	Do. ...	½	49/100	3 feet ...	Ditto ...	Ditto	Ditto	2	27	11	5	19	12	
8	A / 8 b	Do. ...	Do. ...	½	48/100	2½ feet ...	Ditto ...	Ditto	Ditto	2	3	15	4	14	14	

	Mds.	Sers.	Chs.	
Average 4 feet spacing	5	18	0	per acre
„ 3½ „ „	6	12	15	„ „
„ 3 „ „	6	8	8	„ „
„ 2½ „ „	5	8	8	„ „

Statement No. 6

SHOWING THE RESULTS OF SPACING EXPERIMENT WITH COTTON CARRIED OUT AT HANSI AGRICULTURAL STATION DURING KHARIF 1920.

Serial No.	Block and plot No.	Variety.	Previous crop.	Area of sub-plot in acres.	Area harvested in acres.	Spacing.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	A / 13 *a*	White flowered Indicum Bhatia selected.	Wheat ...	½	21,015 / 43,560	2½ feet ...	25th April 1920 ...	15th September 1920	20th December 1920	3	17	2	7	4	4	Ploughing ... 2 Harrowing ... 1 Sohaging ... 3 Waterings ... 3 Hoeing ... 4
2	A / 13 *b*		Do. ...	½	21,516 / 43,560	2 feet ...	Ditto ...	Ditto	Ditto	3	5	10	6	14	5	
3	A / 14 *a*		Do. ...	½	21,676 / 43,560	1½ feet ...	Ditto ...	Ditto	Ditto	2	26	10	5	14	4	
4	A / 14 *b*		Do. ...	½	20,265 / 43,560	2½ feet ...	Ditto ...	Ditto	Ditto	1	37	6	4	6	5	
5	A / 15 *a*		Do. ...	½	21,416 / 43,560	2 feet ...	Ditto ...	Ditto	Ditto	1	33	11	3	29	13	
6	A / 15 *b*		Do. ...	½	21,475 / 43,560	1½ feet ...	Ditto ...	Ditto	Ditto	1	28	5	3	18	9	

Mds. Srs. Chs.

Average 2½ feet spacing ... 6 3 13 per acre.
„ 2 „ ... 5 2 1 „
„ 1½ „ ... 4 16 7 „

Statement No. 7

SHOWING THE RESULTS OF COTTON SOWN BROAD CAST *VERSUS* IN LINES AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1920.

Serial No.	Block and plot No.	Variety.	Treatment.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	D / 3	White flowered Neglectum Bhatia selected.	Broad cast ...	1	41,622 / 43,560	4th May 1920 ...	14th September 1920	20th December 1920	7	16	1	7	29	14	Ploughing ... 1 Harrowing ... 1 Sohaging ... 2 Watering ... 3 Hoeing ... 4
2	D / 4		In lines ...	1	41,906 / 43,560	3rd May 1920 ...	Ditto	Ditto	7	1	6	7	12	8	

Statement No. 8

SHOWING THE RESULTS OF DIFFERENT NUMBER OF HOEINGS WITH COTTON DURING KHARIF 1920 AT THE HANSI AGRICULTURAL STATION.

Serial No.	Block and plot No.	Variety.	Treatment.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	D / 1	White flowered Neglectum Bhatia selected.	2 Kasola hoeings ...	1	40,732 / 43,560	3rd May 1920	14th September 1920	20th December 1920	7	14	14	7	35	6	Ploughing ... ... 1 Harrowing ... ... 1 Sohaging ... ... 2 Waterings 3
2	D / 2		3 ditto ...	1	42,265 / 43,560	4th May 1920 ...	Ditto ...	Ditto ...	6	19	9	6	27	8	
3	D / 3		4 ditto ...	1	41,622 / 43,560	Ditto ...	Ditto ...	Ditto ...	7	16	1	7	29	4	

Statement No. 9

SHOWING THE RESULTS OF DIFFERENT METHODS OF HOEINGS WITH COTTON DURING KHARIF 1920 CONDUCTED AT THE HANSI AGRICULTURAL STATION.

Serial No.	Block and plot No.	Variety.	Treatment.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	D / 4	White flowered Neglectum Bhatia selected.	Sown in lines 4 Kasola hoeings	1	41,906 / 43,560	3rd May 1920 ...	14th September 1920	20th December 1920	7	1	6	7	12	8	Ploughing ... ... 1 Harrowing ... ... 1 Sohaging ... ... 2 Waterings 3
2	D / 5		Ditto 4 country plough hoeings.	1	41,994 / 43,560	Ditto ...	Ditto ...	Ditto ...	5	39	4	6	8	7	
3	D / 6		Ditto 4 Horse hoe hoeings.	1	41,658 / 43,560	Ditto ...	Ditto ...	Ditto ...	6	31	4	7	3	10	
4	D / 7		Ditto 4 Gujrat hoe hoeing.		39,150 / 43,560	Ditto ...	Ditto ...	Ditto ...	6	38	1	7	19	6	

Statement No. 10

SHOWING THE RESULTS OF DEEP AND SHALLOW CULTIVATION EXPERIMENTS WITH COTTON CARRIED OUT AT HANSI AGRICULTURAL STATION DURING KHARIF 1920.

Serial No.	Block and plot No.	Variety.	Treatment.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn Maunds.	Actual outturn Seers.	Actual outturn Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks:
1	D/8	White flowered Neglectum Bhatla S.	Country plough ..	1	39,743 / 43,560	3rd May 1920	4th September 1920	30th December 1920	5	21	12	6	3	1	Ploughing ... ... 1 Harrowing ... ... 1 Sohaging ... ... 2 Watering ... ... 3 Hoeing 4
2	D/9	Ditto	Rajah „ ...	1	32,252 / 43,560	Ditto	Ditto	Ditto	5	16	5	6	0	1	
3	D/10	Ditto	Sabul „ ...	1	41,130 / 43,560	2nd May 1920	Ditto	Ditto	7	19	10	7	37	5	

Statement No. 11

SHOWING THE RESULTS OF EARLY AND LATE SOWING EXPERIMENTS WITH COTTON CONDUCTED AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1920.

Serial No.	Block and plot No.	Variety.	Treatment	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of First picking.	Date of Last picking	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	E/13 a	4-F.	Early sown in lines ...	½	20,751 / 43,560	6th April 1920 ...	14th August 1920 ...	20th December 1920	1	35	15	3	39	6	Ploughing ... ... 5 Harrowing ... ... 4 Sohaging ... ... 5 Watering ... ... 2 Hoeing 4
2	E/13 b	White flowered Neglectum Bhatla S.	Ditto	½	20,689 / 43,560	Ditto ...	Ditto ...	Ditto	2	33	11	5	14	6	
3	E/14 a	4-F.	Late sown at 6 seers per acre.	¼	9,778 / 43,560	29th April 1920 ...	25th September 1920	Ditto	0	31	3	3	18	15	
4	E/14 b	White flowered Neglectum Bhatla S.	Ditto	¼	9036 / 43,5[illegible]	Ditto ...	Ditto ...	Ditto	1	14	1	6	20	6	
5	E/14 c	4-F.	Late sown at 10 seers per acre.	¼	9,700 / 43,569	Ditto ...	Ditto ...	Ditto	0	39	2	4	15	11	
6	E/14 d	White flowered Neglectum Bhatla S.	Ditto	¼	9,910 / 43,560	Ditto ...	Ditto ...	Ditto	1	18	10	6	17	11	

Statement No. 12

SHOWING THE RESULTS OF HYDRAULIC EXPERIMENT CARRIED OUT AT THE HANSI AGRICULTURAL STATION DURING KHARIF 1920.

Serial No.	Block and plot No.	Variety.	Previous crop.	Area sown in acres.	Area harvested in acres.	Treatment.	Date of Sowing.	Date of First picking.	Date of Last picking.	Actual outturn. Maunds.	Actual outturn. Seers.	Actual outturn. Chataks.	Outturn per acre. Maunds.	Outturn per acre. Seers.	Outturn per acre. Chataks.	Remarks.
1	E / 11 a 1	White flowered Neglectum Bh. S.			4,008 / 43,560	Watering 1, hoeing 5 ...	29th April 1920 ...	15th September 1920.	20th December 1920.	0	12	12	3	18	9	Ploughing ... 5 Harrowing ... 3. Sohaging ... 4.
2	E / 11 a 2	Ditto			4,212 / 43,560	Do. 2, do. 4 ...	Ditto ...	Ditto	Ditto	0	25	11	6	25	11	
3	E / 11 a 3	Ditto			4,348 / 43,560	Do. 3, do. 3 ...	Ditto ...	Ditto	Ditto	0	21	8½	5	15	11	
4	E / 11 a 4	Ditto			4,280 / 43,560	Do. 4, do. 2 ...	Ditto ...	Ditto	Ditto	0	18	2½	4	24	13	
5	E / 11 a 5	Ditto			4,068 / 43,560	Do. 5, do. 1 ...	Ditto ...	Ditto	Ditto	0	20	15	5	24	3	
6	E / 11 b 1	4-F. ...			3,882 / 43,560	Do. 1, do. 5 ...	Ditto ...	Ditto	Ditto	0	10	8½	2	38	3	
7	E / 11 b 2	Do. ...			4,266 / 43,560	Do. 2, do. 4 ...	Ditto ...	Ditto	Ditto	0	24	1½	6	6	0	
8	E / 11 b 3	Do. ...	Gowara	1/10	4,220 / 43,560	Do. 3, do. 3 ...	Ditto ...	Ditto	Ditto	1	7	4½	12	0	1	
9	E / 11 b 4	Do. ...			4,260 / 43,560	Do. 4, do. 2 ...	Ditto ...	Ditto	Ditto	0	25	1½	6	16	10	
10	E / 11 b 5	Do. ...			4,246 / 43,560	Do. 5, do. 1 ...	Ditto ...	Ditto	Ditto	0	30	11	5	25	1	
11	E / 12 b 1	White flowered Indicum Bh. S.			4,104 / 43,560	Do. 1, do. 5 ...	Ditto ...	Ditto	Ditto	0	26	0	6	35	10	
12	E / 12 b 2	Ditto			4,184 / 43,560	Do. 2, do. 4 ...	Ditto ...	Ditto	Ditto	0	37	13	9	33	11	
13	E / 12 b 3	Ditto			4,286 / 43,560	Do. 3, do. 3 ...	Ditto ...	Ditto	Ditto	1	3	3	10	38	14	
14	E / 12 b 4	Ditto			4,196 / 43,560	Do. 4, do. 2 ...	Ditto ...	Ditto	Ditto	0	36	6	9	3	1	
15	E / 12 b 5	Ditto			3,929 / 43,560	Do. 5, do. 1 ...	Ditto ...	Ditto	Ditto	0	20	0	5	21	13	

Statement No. 13

SHOWING THE RESULTS OF VARIETAL TEST OF WHEAT CONDUCTED AT HANSI AGRICULTURAL STATION DURING RABI 1920-21.

Serial No.	Block and Plot. Block.	Plot.	Name of type.	Previous crop.	Area harvested in acres.	Date of Sowing.	Date of Harvesting.	Actual Outturn. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn per acre in terms of standard. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Remarks.
1		1—2 / 1	Punjab 14 ...	4-F. ...		6th November 1920 ...	8th April 1921	1	27½	3	32	20	10	45	24	20	10	45	24	Ploughings 6
2		1—2 / 2	,, 8-A ...	Cotton		Ditto ...	Ditto	1	31½	4	3	21	18	48	36	19	32	43	32	Harrowing 6
3		1—2 / 3	,, 14 ...	Do.		Ditto ...	Ditto	1	24½	3	20	19	14	42	0	19	14	42	0	Sohaging 6
4		1—2 / 4	,, 8-B ...	Do.		Ditto ...	4th April 1921	1	15½	2	20	16	26	30	0	19	17	40	32	Hoeing 2
5		1—2 / 5	,, 14 ...	Do.		Ditto ...	3rd April 1921	1	25	3	12	19	20	39	24	19	20	39	24	Watering 2
6		1—2 / 6	,, 9-C ...	Do.	1/12	Ditto ...	28th March 1921	1	23½	3	4	19	2	37	8	20	4	43	2	Weeding 1
7		1—2 / 7	,, 14 ...	Do.		Ditto ...	3rd April 1921	1	29	3	35	20	28	46	20	20	28	46	20	
8		1—2 / 8	,, 16-A ...	Do.		Ditto ...	28th March 1921 ... / 2nd April 1921	1	33½	4	25	22	2	55	20	19	14	51	30	
9		1—2 / 9	,, 14 ...	Do.		Ditto ...	Ditto	1	20	4	30	18	0	57	0	18	0	57	0	
10		1—2 / 10	,, 17-B ...	Do.		Ditto ...	30th March 1921	0	38	3	38	11	16	47	16	17	17 1/2	49	20	
11	A	1—2 / 11	,, 14 ...	Do.		Ditto ...	1st April 1921	1	16½	3	20	16	35	42	0	16	35	42	0	
12		1—2 / 12	,, 20-C ...	Do.	3,319/43,560	Ditto ...	30th March 1921	1	9½	3	23	16	9 5/8	46	36 11/16	16	30 1/2	41	32 9/16	
13		1—2 / 13	,, 14 ...	Do.	2,616/43,560	Ditto ...	28th March 1921	1	0	2	20	16	26	41	25 1/8	16	26	41	25 1/8	
14		1—2 / 14	,, 11 ...	Do.	2,858/43,560	Ditto ...	30th March 1921	1	13½	3	8	20	15 7/16	48	30 7/8	18	12 5/32	39	21	
15		1—2 / 15	,, 14 ...	Do.	3,492/43,560	Ditto ...	31st March 1921	1	24	3	0	19	38 5/16	37	16 7/8	19	38 5/16	37	16 7/8	
16		1—2 / 16	,, 17 ...	Do.	3,263/43,560	Ditto ...	26th March 1921	1	3	2	13	14	14 3/4	31	1 1/2	15	31 13/32	32	30 7/32	
17		1—2 / 17	,, 14 ...	Do.	3,024/43,560	Ditto ...	Ditto	0	32½	1	38	11	24 1/2	28	3 9/16	11	24 1/2	28	3 9/16	
18		1—2 / 18	Pusa 12 ...	Do.	3,500/43,560	Ditto ...	21st March 1921	1	9½	2	24	15	16 1/2	32	14 5/16	15	28 1/4	31	11 25/32	
19		1—2 / 19	Punjab 14 ...	Do.		Ditto ...	26th March 1921	1	26	2	35	19	32	34	20	19	32	34	20	
20		1—2 / 20	Federation ...	Do.	1/12	Ditto ...	21st March 1921	1	11¼	3	14	15	15	40	8	19	14	37	38	
21		1—2 / 21	Punjab 14 ...	Do.		Ditto ...	31st March 1921	1	23	3	18	18	36	41	16	18	36	41	16	

Statement No. 13 *b*

SHOWING THE RESULTS OF VARIETAL TEST OF WHEAT CONDUCTED AT HANSI AGRICULTURAL STATION DURING RABI 1920-21.

Serial No.	Block and Plot. Block.	Plot.	Name of type.	Previous crop.	Area harvested in acres.	Date of Sowing.	Date of Harvesting.	Actual outturn. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn per acre in terms of standard. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Remarks.
1	A	3—4/1	Punjab 14	4-F. cotton.	1/12	4th November 1920 ...	8th April 1921	1	3½	2	34	13	2	34	8	13	2	34	8	Ploughings 6
2		3—4/2	Federation	Do.		Ditto ...	4th April 1921	0	30	1	10	9	0	15	0	10	11	30	24	Harrowings 6
3		3—4/3	Punjab 14	Do.		Ditto ...	Ditto	0	25	2	10	7	20	27	0	7	20	27	0	Sohagings 6
4		3—4/4	Pusa 12	Do.		Ditto ...	28th March 1921	1	1	1	30	12	12	21	0	10	3½	25	8	Hoeings 2
5		3—4/5	Punjab 14	Do.		Ditto ...	4th April 1921	1	2¼	1	38	12	27	23	16	12	27	23	16	Waterings 2
6		3—4/6	„ 17	Do.		Ditto ...	Ditto	1	1	2	5	12	12	25	20	12	22½	25	8	Weeding 1
7		3—4/7	„ 14	Do.		Ditto ...	3rd April 1921	1	1½	2	10	12	18	27	0	12	18	27	0	
8		3—4/8	„ 11	Do.		Ditto ...	Ditto	1	6	2	15	13	32	28	20	12	34⅛	31	20	
9		3—4/9	„ 14	Do.		Ditto ...	Ditto	1	4¼	3	0	13	0	36	13	13	11	36	0	
10		3—4/10	„ 20-C.	Do.		Ditto ...	Ditto	1	2⅝	2	34	12	30	34	8	13	31 17/32	36	8 23/32	
11		3—4/11	„ 14	Do.	3,193/43,560	Ditto ...	1st April 1921	1	2	2	27	14	12 1/16	36	17 7/16	14	12 1/16	36	17 3/16	
12		3—4/12	„ 17-B	Do.	3,150/43,560	Ditto ...	31st March 1921	0	33	2	8	11	16 5/16	30	16 7/8	14	17 9/16	36	28 7/32	
13		3—4/13	„ 14	Do.	3,063/43,560	Ditto ...	Ditto	1	1	2	26	14	23 1/16	36	39	14	23 1/16	36	39	
14		3—4/14	„ 16-A	Do.	2,340/43,560	Ditto ...	1st April 1921	1	3¼	2	34	20	5⅛	53	2⅝	18	3 1/16	40	24 5/16	
15		3—4/15	„ 14	Do.	3,003/43,560	Ditto ...	3rd April 1921	1	19½	3	2	21	23 1/16	44	9⅝	21	23 1/16	44	9⅝	
16		3—4/16	„ 9-C	Do.		Ditto ...	2nd and 3rd April 1921 ...	1	24½	2	35	19	14	34	20	19	33 1/32	37	4 13/16	
17		3—4/17	„ 14	Do.		Ditto ...	3rd April 1921	1	20¼	2	20	16	3	30	0	18	3	30	0	
18		3—4/18	„ 8 B	Do.	1/12	Ditto ...	Ditto	1	10½	2	17	15	6	29	4	19	26	32	0	
19		3—4/19	„ 14	Do.		Ditto ...	1st April 1921	1	30¼	3	0	21	9	36	0	21	2	36	0	
20		3—4/20	„ 8-A	Do.		Ditto ...	3rd April 1921	1	28½	3	10	20	22	39	0	16	3½	34	32	
21		3—4/21	„ 14	Do.		Ditto ...	3rd and 8th April 1921 ...	0	36½	2	32	10	38	33	24	10	38	33	24	

Statement No. 14

SHOWING THE RESULTS OF VARIETAL TEST WITH SUGARCANE VARIETIES DURING KHARIF 1920 AT THE HANSI AGRICULTURAL STATION.

Block and plot.	Treatment before sowing.	Name of variety.	Area sown in acres.	Area harvested in acres.	Actual outturn.										Outturn per acre.						Percentage of juice to canes.	Percentage of gur to juice.	Percentage of gur to cane.	Remarks.
					Unstripped canes.		*Tops.*		*Canes.*		*Juice.*		*Gur.*		*Canes.*		*Juice.*		*Gur.*					
					Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.	Maunds.	Seers.				
A				5,085																				
19 *a* 1		Local ...		43,560	34	18	5	25½	22	22	11	18½	2	13¼	193	6⅞	98	7$\frac{11}{16}$	19	38⅝	50·83	14·85	7·55	Ploughings 11
A				2,929																				Sohagings 25
19 *a* 2		Behar ...		43,560	13	35	3	21	7	24½	3	29½	0	22¼	113	14$\frac{11}{16}$	55	26⅜	8	11⅜	49·10	14·88	7·31	Harrowings 3
A				4,717																				Hoeings 9
19 *a* 3		Local ...		43,560	31	16	5	18	20	4	9	30	1	22½	189	25	92	0	14	29$\frac{7}{16}$	48·52	16·02	7·77	Waterings 12
A				4,095																				
19 *a* 4		Lalri ...		43,560	29	33½	6	16½	18	22½	9	8½	1	23¼	197	14¼	97	39⅞	16	32$\frac{13}{16}$	49·65	17·16	8·52	
A				4,725																				
20 *a* 1		Local ...		43,560	41	32½	8	32	27	6½	14	25	2	28	250	16½	134	33⅛	24	35$\frac{11}{16}$	53·84	18·46	9·94	
A				4,815																				
20 *a* 2		Mango ...		43,560	46	12½	11	7	24	17	13	0	2	10¼	220	38⅝	117	24⅝	20	16$\frac{7}{16}$	53·23	17·36	9·24	
A				4,005																				
20 *a* 3		Local ...		43,560	47	1	9	10	28	7	16	2½	2	29¼	306	17$\frac{11}{16}$	174	28$\frac{1}{16}$	29	33$\frac{11}{16}$	57·01	17·08	9·74	
A				1,035																				
20 *a* 4		Java 105 ...		43,560	6	26½	2	2	3	7	1	32	0	12	133	25$\frac{1}{16}$	75	10¼	12	25$\frac{1}{16}$	56·69	16·67	9·45	
A				4,995																				
21 *a* 1		Local ...		43,560	48	33	9	26	32	15	17	21	3	6	282	13$\frac{5}{16}$	152	33¼	27	18$\frac{13}{16}$	54·13	17·97	9·73	
A				8,085																				
21 *a* 2		Suretha ...		43,560	47	10	9	37½	30	33½	17	3	2	35	264	6⅜	146	10$\frac{13}{16}$	24	25⅛	55·37	16·84	9·32	
A				3,645																				
21 *a* 3		Local ...		43,560	39	15⅛	7	28¾	24	21⅞	11	36½	2	4¼	293	21¾	142	14½	25	6$\frac{13}{16}$	48·50	17·68	8·57	
A																								
21 *a* 4		Dhaura ...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Farm yard manure at the rate of 15 tons per acre.

Statement No. 15

SHOWING THE RESULTS OF VARIETAL TEST WITH SUGARCANE VARIETIES DURING KHARIF 1920 AT THE HANSI AGRICULTURAL STATION.

Block and plot.	Treatment before sowing.	Name of variety.	Area sown in acres.	Area harvested in acres.	Actual outturn. Unstripped cane. Maunds.	Unstripped cane. Seers.	Tops. Maunds.	Tops. Seers.	Canes Maunds.	Canes Seers.	Juice. Maunds.	Juice. Seers.	Gur. Maunds.	Gur. Seers.	Outturn per acre. Canes. Maunds.	Canes. Seers.	Juice. Maunds.	Juice. Seers.	Gur. Maunds.	Gur. Seers.	Percentage of juice to canes.	Percentage of gur to juice.	Percentage of gur to canes.	Remarks.
A	Farm yard manure at 15 tons per acre and castor cake at 15 maunds per acre.	Local ...	¼	7,440	61	5½	10	1½	41	16½	20	33¾	4	4¾	242	18 5/16	192	1 9/16	24	4 9/16	50·33	19·76	9·95	Ploughings ... 11
19 b 1 A				43,560																				Harrowings ... 3
		Mango ...		9,450	113	16	20	10	71	2½	36	6	6	9¾	327	22 9/16	166	25⅝	28	31 3/16	50·87	17 27	8·79	Sohaging ... 25
19 b 2 A				43,560																				
		Java 105 ...		7,898	72	30	12	37½	50	24½	31	38½	5	10½	279	5¾	176	36⅝	29	1	63·21	16·70	10·56	Hoeings ... 9
20 b 1 A				43,560																				Waterings ... 12
		Suretha ...		8,710	119	2½	15	30½	84	36	50	1½	8	38	424	3⅞	250	9¾	44	30 5/16	58·94	17·89	10·54	
20 b 2 A				43,560																				
		Bihar ...		8,489	95	17½	17	29½	61	16½	35	34½	6	10¾	315	5⅛	184	15/16	32	6 1/16	58·40	17·48	10·21	
21 b 1 A				43,560																				
		Lalri ...		8,155	125	33½	18	18½	85	12	51	14	7	38½	455	25¼	274	11 7/16	42	21¼	60·20	15·51	9·33	
21 b 2				43,560																				

Statement No. 16

SHOWING THE RESULTS OF COMPARATIVE TEST OF BARLEY TYPES GROWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1920–21.

Serial No.	Block and plot.	Name of type.	Date of sowing.	Date of harvesting.	Area sown in acres.	Area harvested in acres.	Actual outturn. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Outturn per acre. Grain. Maunds.	Grain. Seers.	Bhusa. Maunds.	Bhusa. Seers.	Remarks.
1	32 / 2 a	Local Barley ...	10th December 1920	14th April 1921 ...			0	38½	2	0	6	29½	14	0	Ploughings ... 2
2	32 / 2 b	Barley Type I ...	Ditto	Ditto ...			1	0	2	10	7	0	15	30	Harrowings ... 2
3	32 / 2 e	,, ,, II ...	Ditto	Ditto ...			1	2½		7	7	17½	15	9	Sohaging ... 4
4	32 / 2 d	Local Barley ...	Ditto	Ditto ...	¼	¼	0	37½	1	38	6	22½	13	26	Hoeing ... 1
5	32 / 2 e	Barley Type IV ...	Ditto	Ditto ...			0	09	2	5	6	33	14	35	Watering ... 1
6	32 / 2 f	,, ,, V ...	Ditto	Ditto ...			0	32	1	30	5	24	12	10	
7	32 / 2 g	Local Barley ...	Ditto	Ditto ...			0	22	1	4	3	34	7	28	

Statement No. 17

SHOWING THE RESULTS OF VARIETAL TEST EXPERIMENT OF GRAMS SOWN AT THE HANSI AGRICULTURAL STATION DURING RABI 1920-21.

Serial No.	Name of block and plot.	Name of type.	Area sown in acres.	Area harvested in acres.	Date of Sowing.	Date of Harvesting.	Actual outturn. Grain. Maunds.	Actual outturn. Grain. Seers.	Actual outturn. Bhusa. Maunds.	Actual outturn. Bhusa. Seers.	Outturn per acre. Grain. Maunds.	Outturn per acre. Grain. Seers.	Outturn per acre. Bhusa. Maunds.	Outturn per acre. Bhusa. Seers.	Remarks.
1	B 11/1	Local Gram ...			12th November 1920	2nd April 1921 ...	0	7	0	8	3	20	4	0	Ploughings ... 5
2	B 11/2	Gram No. 7 ...			Ditto ...	Ditto ...	0	5⅜	0	6	2	27½	3	0	Harrowings ... 5
3	B 22/3	Local Gram ...			Ditto ...	Ditto ...	0	6⅜	0	7	3	2½	3	20	Sohagings ... 7
4	B 11/4	Gram No. 15 ...			Ditto ...	26th March 1921	0	4	0	4	2	0	2	0	Watering ... 1
5	B 11/5	Gram Local ...			Ditto ...	Ditto ...	0	5½	0	9	2	30	4	20	Weeding ... 1
6	B 11/6	Gram No. 17 ...			Ditto ...	Ditto ...	0	8⅝	0	10	4	20½	5	0	
7	B 11/7	Gram Local ...	1/20	1/20	Ditto ...	2nd April 1921 ...	0	9½	0	8	4	30	4	0	
8	B 11/8	Gram No. 20 ...			Ditto ...	Ditto ...	0	13¾	0	12	6	35	6	0	
9	B 11/9	Gram Local ...			Ditto ...	Ditto ...	0	7¾	0	8½	3	35	4	10	
10	B 11/10	White Burma No. 1 ...			Ditto ...	26th March 1921	0	1½	0	2	0	30	1	0	
11	B 11/11	Local Gram ...			Ditto ...	Ditto ...	0	3⅝	0	4	1	32½	2	0	
12	B 11/12	White Burma No. 2 ...			Ditto ...	Ditto ...	0	3¼	0	3½	1	25	1	30	
13	B 11/13	Local Gram ...			Ditto ...	Ditto ...	0	4¼	0	5	2	5	2	20	
14	B 11/14	Black Burma No. 1 ...	1/80	1/80	Ditto ...	25th March 1921...	0	¼	0	2	0	20	4	0	
15	B 11/15	Local Gram ...	1/40	1/40	Ditto ...	Ditto ...	0	1¾	0	2	1	30	2	0	
16	B 12/16	Black Burma No. 2 ...	1/80	1/80	Ditto ...	Ditto ...	0	1/16	0	½	0	35	1	0	
17	B 11/17	Local Gram ...	1/20	1/20	Ditto ...	Ditto ...	0	9½	0	10	4	30	5	0	

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00134233

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on 01 February, 2020